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CONTENTS

Abstracts of Principal Articles

Construction and Application of C.M.B.G. Rotary Transfer Presses ..... P. 996

Rotary transfer presses are now being built by Costruzioni Meccaniche Benelli-Gavazzi, Florence, Italy, and the sizes available range from an 18-station, 16-ton machine, to a 16-station, 250-ton machine. All the presses in this range are of generally similar design, and have built-up frames, with cast-iron members which are bolted and keyed together. Hard-chromium-plated steel tie-bars connect the base and crown, and serve as guides for the ram, as well as resisting the pressing forces. There are either one or two crankshafts, and from one to four connecting rods, depending on the size of press. It is usual to feed strip to one or both of the two side stations, where a blank is cut and drawn, and the resulting cup is then passed to circumferentially-disposed stations for further working. Two workpieces can be produced simultaneously, and rotary trimming and spinning tools can readily be incorporated. The company also build in-line transfer, and conventional, presses, and have recently supplied a special countersinking and stamping machine which incorporates standard units from their in-line and rotary presses. (MACHINERY, 92—2/5/58.)

Mercer Airmatic Automatic Sizing Equipment ..... P. 1008

Thomas Mercer (Air Gauges), Ltd., Eywood Road, St. Albans, Herts., have recently introduced automatic grinding machine control equipment, based on their air-gauging system. Known as their Airmatic Sizer, this equipment is a logical outcome of the firm's development work, described in MACHINERY, 89/730—28/9/56, in connection with highly-sensitive pressure switches operated by Bourdon tubes. In the Airmatic Sizer, these switches are employed to control the grinding wheel in-feed. Four types of the equipment are available, two of which control the work diameter directly. Of the latter, one affords 2-stage, and the other, 3-stage control. The other two units are of a differential type, also affording 2- and 3-stage control, and they enable the work to be ground to a matched fit in previously-machined bores. The bores are employed as the basis of reference, and irrespective of variations within the bore tolerance range, closely-controlled fits are consistently maintained. The non-differential equipment, under suitable conditions, affords discrimination within 0·00002 in. to 0·00003 in., and with the differential equipment, the discrimination is of the order of 0·00003 in. (MACHINERY, 92—2/5/58.)

Hand-tool Production in a Swedish Factory ..... P. 1011

Products of the factory of E. A. Bergs Fabriks A.-B., Eskilstuna, Sweden, include pliers, clippers, shears and knives, also wood-working tools such as chisels and plane-irons. In the forging shop, each operator tends a furnace, a board-hammer, a high-speed hammer, and a clipping press. In the machine-shop section devoted to "pivoted" tools, each operator tends from three to six machines. Special-purpose rotary-head multi-station machines, designed and built by the company, are employed for facing and drilling operations on pivoted tools, and the jaw forms and serrations on plier components are profile milled. Extensive use is made of air-operated devices, and mechanical handling aids designed and built by the company. (MACHINERY, 92—2/5/58.)

Instrument for Plotting Tooth-form of a Cam-relieved Helical Cutter ..... P. 1018

If form-relieved milling cutters are made with the front faces of their teeth at an angle other than 90 deg. to their side faces, some correction to the tooth cross-section is necessary. An instrument has been developed whereby a corrected form can be traced either on a steel plate, from which a template can be made, or to an enlarged scale for use in conjunction with an optical projector. The form is derived from the motion of a swinging arm and a slide coupled to a sine bar, and is stated to be such that the cutter can be reground without introducing errors. (MACHINERY, 92—2/5/58.)

Welding Operations on the Lincoln Uniframe Body ..... P. 1019

The 1958 Lincoln cars are of uniframe construction, the welded frame comprising the entire underbody, structural members, rear compartment pan, front engine compartment, and engine supports. All the welding guns are air operated, and considerable care is taken to ensure the best combinations of welding pressure, time and temperature. Initial welding operations are carried out on a roundabout installation, and the weldments are next transferred to a group of welding fixtures, the operations being completed with the bodies mounted on skids. (MACHINERY, 92—2/5/58.)

Federal Automatic Machine for Bracket Manufacture ..... P. 1025

An automatic machine, recently built by the Federal Machine & Welder Co., U.S.A., is designed to projection-weld two reinforcing plates and six bolts to brackets for motor vehicle brake pedals, also to perform certain machining operations. The brackets are loaded by hand into fixtures which are connected together by a double-chain conveyor and indexed by a Geneva mechanism. Reinforcing plates are fed from magazines into holders on the welding heads and after welding has been completed the brackets are carried to stations equipped with unit heads whereby spot-facing, reaming and de-burring operations are completed in succession. The bolts are then fed into the flange holes from vibratory hoppers at each side, and welded in place before the brackets are automatically unloaded. (MACHINERY, 92—2/5/58.)

Gear Production by Powder Metallurgy

Because gears of so many different types are required for a great diversity of products, often in very large numbers, it is important that manufacturing cost should be carefully studied in relation to the characteristics and service performance obtained. Frequently there is a considerable choice of both gear materials and production methods, so that the optimum combination for any particular application may not be easy to determine The majority of precision gears of all forms and sizes are, of course, cut from blanks by certain well-established processes which have been highly developed. For some purposes, however, gears are made efficiently by alternative techniques, including, for example, cold rolling, gravity and pressure die casting, and precision hot forging. Another method, which has been the subject of important advances in recent years, is powder metallurgy. This process is suitable for a wide variety of parts, and although its advantages have been amply demonstrated it does not yet appear to have been adopted on a scale commensurate with its potentialities. In particular, it is contended, powder metallurgy could be effectively employed for the solution of many gear production problems.

Reference may be made, in this connection, to a paper which was presented by Mr. Robert Talmage at the recent Production Meeting and Forum of the Society of Automotive Engineers. This paper, although it embraced the production, by powder metallurgy, of high quality steel parts in general, was particularly concerned with gears, which, it was stated, are now being produced in this manner, in the U.S.A., at the rate of more than 1,000,000 per day. These gears include spur, helical, bevel, face, cluster, partial, and skip-tooth types, and one of the attractions of the method is that they may be made complete with hubs or flanges of special forms, and with parallel, tapered, stepped, keyed, keywayed, splined, square, or eccentric bores. Where quantities are sufficient, suitable gears can normally be made by powder metallurgy more economically than by other processes, and they are being incorporated successfully in products ranging from toys and clocks to business machines and motor-cars. Despite the evidence of reliability that has been afforded, however, it was suggested that metal powder gears have not yet been accepted for many potential applications because designers have insufficient confidence in their properties, and the author went on to discuss the characteristics now obtainable. Various procedures are followed in order to obtain gears of high quality. For example, a sizing or coining operation may be carried out after the work has been sintered, in order to achieve greater accuracy. In other instances, the coining stage is followed by re-sintering, to improve the strength of the finish gear. Alternatively strength may be increased by infiltration of the porous sintered component with copper.

Such expedients may give good results, but according to the experience of Mr. Talmage it is only necessary, for the majority of applications, to compact and sinter, provided that material of suitable quality and composition is employed and correctly processed. For gears and other high strength parts, the addition of copper powder and graphite is advocated, the proportions being so selected that the finished product is a 0·7 per cent carbon steel with a copper content of 5 per cent. Careful compounding and thorough blending are necessary, and the compacting pressure greatly influences the final strength. An interesting graph was presented which indicates that the compacting pressure must be raised from 20 to 50 tons per sq. in. to obtain an increase in density from 6·0 to about 6·7. Even more striking, were curves showing the effects of composition on tensile strength for various densities. Considering a density of 6·6 for example, the strength for 0·1 per cent carbon is about 26,000 lb. per sq. in., but with the addition of 5 per cent of copper it is increased to about 46,000 lb. per sq. in. A somewhat higher value is obtained with 0·7 per cent carbon alone, and when the copper and high carbon contents are combined the figure is raised to approximately 75,000 lb. per sq. in. It should be noted, moreover, that the yield strength of the sintered steel is practically the same as the tensile strength.

For gears, wear resistance is also important, and in this respect the pressed and sintered steel parts are claimed to be very satisfactory. Good wearing qualities are attributed to the fact that the material, when correctly sintered, contains practically no ferrite; to the high surface finish obtainable from good quality tools; and to the slight surface porosity

(*Continued on page* 1044)

Construction and Application of C.M.B.G. Rotary Transfer Presses

In MACHINERY, 92/616—14/3/58, reference was made to the production of a lampholder pressing on a rotary transfer press, and some details were given of the design of the press and the lay-out of the tools. Rotary transfer presses have been made for a number of years by Costruzioni Meccaniche Benelli-Gavazzi, Florence, Italy, who are represented in this country by K. S. Paul, Ltd., Great Western Trading Estate, Park Royal Road, London, N.W.10. The Benelli-Gavazzi company have had extensive experience in the construction of power presses, and, in addition to rotary transfer presses, build in-line transfer presses and inclined open-front presses, with pneumatic clutches, also various other metal-forming machines. This company has developed their rotary design in order to provide a compact production unit, with facilities for carrying out an extensive variety of pressing operations, and for the incorporation of specialized forming units, such as rotary beaders and trimmers, in the press set-ups. It is also considered that the ease with which the presses can be set up is such that they can be employed economically for the production of parts in relatively modest quantities.

One of the latest 80-ton, 22-station C.M.B.G. rotary transfer presses is seen in Fig. 1, during the course of try-out, with the tooling equipment installed. Particular attention has been paid to rigidity of construction, and each press is built up from box-section, cast-iron members, which are keyed and bolted together, to form a strong, rigid frame. Additional strength is provided by the four pillars which pass through the crown, side members, and base of the frame, and whereon the ram slides. In Fig. 1, the nuts at the upper end of the front pair of pillars are visible at *A*, and the ram is indicated at *B*. The pillars are hard chromium plated, and the ram is provided with adjustable bronze sleeve bearings.

The machine shown has two crankshafts, housed in the base of the frame, and these shafts are connected by herringbone gears at each end to maintain synchronization. Four high-tensile steel connecting rods, of fabricated construction, couple the crankshafts to the ram. The big-end bearings of the connecting rods are of the split, white-metal lined type, and the bearings for the ram pivot pins are fitted with solid bronze bushes. At each end of the ram, there are pneumatic compensating cylinders, to counterbalance the weight of the moving parts, and, in positions corresponding to the tool stations, holes are provided in the ram for the passage of coupling rods to air cylinders, for ejection or cushioning, which are mounted on top of the crown. Other presses in the C.M.B.G. range are of a slightly different design, but the general arrangement of a

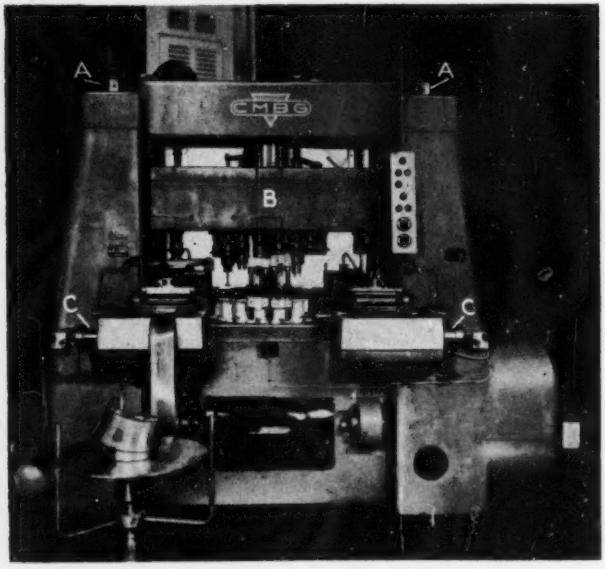


Fig. 1. A Rotary Transfer Press of One of the Latest Designs Built by Costruzioni Meccaniche Benelli-Gavazzi, Florence, which has a Capacity of 80 tons, and 22 Stations

built-up, cast-iron frame, and four pillars, is maintained. Either one or two crankshafts may be employed, depending on the size of the unit, and these shafts may be connected to the ram by one, two, or four connecting rods. Drive is transmitted to the shafts (or shaft) from a reduction gearbox, which is coupled to an air-operated clutch and flywheel unit. The clutch is controlled by a solenoid-actuated valve, and the flywheel is driven either by multiple V-belts directly from the motor, or through a P.I.V. gear unit.

As may be seen from Fig. 2, tool stations are arranged around the ram, so that the pressings follow a circular path. Generally, separate adjustable holders are provided for the upper tool members, and individual bolsters for the lower tools. Transfer of the pressings from one station to the next is effected by pairs of fingers, which are pivoted on an annular member, centrally-located beneath the ram. The fingers of each pair are coupled together by toggle links, and the central connecting pin of these links passes through the end of a horizontally-disposed plunger. This plunger moves in a bore in the annular member and its inner end carries a roller, which engages a cam plate on a pillar below the ram. The arrangement is such that as the ram is moved downwards, the plunger is thrust radially outwards, and the toggle links are straightened, so that the fingers are moved apart. As the ram rises, the plunger is moved inwards by the action of a spring, and the fingers are brought together. As already indicated in MACHINERY, 92/615—14/3/58, movement of the fingers is interlocked electrically with the ram driving mechanism, and if the fingers do not pick up a workpiece, the press is stopped. A signal lamp indicates the station at which the fault has occurred.

The annular member that carries the fingers is connected to the crankshaft drive, and is moved intermittently, in phase with the ram motions. When the ram approaches the top of its stroke and the fingers have closed on to the pressings at the various tool stations, the annular member is indexed in an anti-clockwise direction (as viewed from above), so that each pressing is moved to the next station. Then, the annular member is held in this position while the ram descends, and the fingers release the workpieces, and move sideways clear of the tools. It will be appreciated that the annular member and transfer fingers are indexed in one direction only, and that there is no return movement to position the fingers in readiness for successive transfer cycles. All the fingers are of the same general design, but are of opposite hand in each pair, and usually take the form of J-shaped, flat plates, with V-notches in their curved ends, for gripping the pressings.

Fig. 2. Close-up View of the Rotary Work-transport Mechanism on a C.M.B.G. 18-station 50-ton Transfer Press

In addition to the circumferentially-disposed tool-stations, C.M.B.G. presses have a station at each side of the ram, which can be employed for blanking and drawing operations, when strip material is being worked, or for feeding pre-cut blanks or partially-formed workpieces, supplied from magazine loading units. At each side-station there are auxiliary drive arrangements for operating feed-rollers, also provision for cutting two rows of blanks, in staggered formation, from the strip, with consequent economies in material. The movement of the feed rollers, and, consequently, the length of strip fed at each cycle, can be varied by means of an adjustable-throw crank mechanism.

On the press shown in Fig. 1, zig-zag blanking is accomplished by reciprocating the complete feed-in and take-off roll mechanisms, by pneumatic power. Separate cylinders are provided for the feed-in and take-off units, and those for the feed units at the front of the press are indicated at *C*. Special arrangements are incorporated to maintain the feed-in and take-off units at each side in synchronism, and the mechanism is claimed to feed material consistently within 0·5 mm. (0·019 in.). On this new press, moreover, it is possible to feed blanks and partially-finished workpieces from each side, through openings in the frame side-members, and feed tables or magazine units can readily be

fitted. The tool area is unrestricted, and there is complete freedom for tool-adjustment or replacement.

A close-up view of one of the side stations of an older C.M.B.G. press, arranged for feeding partially-formed workpieces, is given in Fig. 3. The workpieces are loaded into a vertical magazine, which is mounted on the platform *D*, but the magazine has been removed to enable the transfer arrangements to be seen. Transfer is effected by means of gripper jaws secured to reciprocating shuttle bars at the sides of the transfer ways. The mechanism for actuating the shuttle bars is connected to the press crankshaft, and the bars move inwards, so that the jaws grip a part; advance to carry the part forwards; move apart to release the pressing; and are then returned, in phase with the press cycle. In this manner, parts are carried through two intermediate stations, from the pick-up position, and are deposited on a die at one of the side tool-stations. In this instance, partially-formed workpieces are fed to both side stations of the press and move simultaneously through sets of tools, each set occupying half the number of available circumferentially-disposed stations.

Each C.M.B.G. rotary transfer press has a built-in compressed air system which is employed for actuating the clutch and brake unit for the main drive, also the ram stroke compensation mechanism, and for supplying the pneumatic cylinders for the ejectors or cushions of the upper or lower tool units. A control panel is mounted at one side of the press frame, and incorporates a main switch, also switches for inching the ram, and for single-stroke or continuous running.

MAGAZINE FOR BLANKS

A typical magazine unit for feeding circular blanks to one of the side tool-stations of a C.M.B.G. rotary transfer press is shown in Fig. 4. The press is of the single-crankshaft, single-connecting-rod type, the crankshaft being visible at *A*, and the big-end of the connecting rod at *B*, through the opening in the front of the base. Two universally-jointed shafts may also be seen, and these shafts transmit drive from electric motors in the lower part of the base to rotary-spinning or similar tools, at two of the circumferentially-disposed stations above.

The magazine unit has a circular platen *C*, which supports the stack of blanks to be fed into the press, and this platen is mounted on the upper end of a stem that is secured to a carriage *D*. There are two vertical pillars, whereon the carriage slides, and between the pillars there is a screw, with a thread of square section, which is engaged by a nut fitted to the carriage. A flange-mounted motor *E* drives the screw, through a reduction gearbox and an electro-magnetic clutch. The arrangement is such that each time a blank is removed from the stack, the motor drive is engaged and the stack is raised.

At the side of the magazine there is a third pillar which supports a micro-switch *F*. The operating finger of this switch bears against the side of the stack of blanks, and, when the stack is nearly exhausted, the finger can move inwards, so that the switch is tripped, and the press is stopped.

Blanks are advanced from the magazine stack towards the side tool-station by means of a transfer yoke *G*, which is reciprocated in phase with the press cycle.

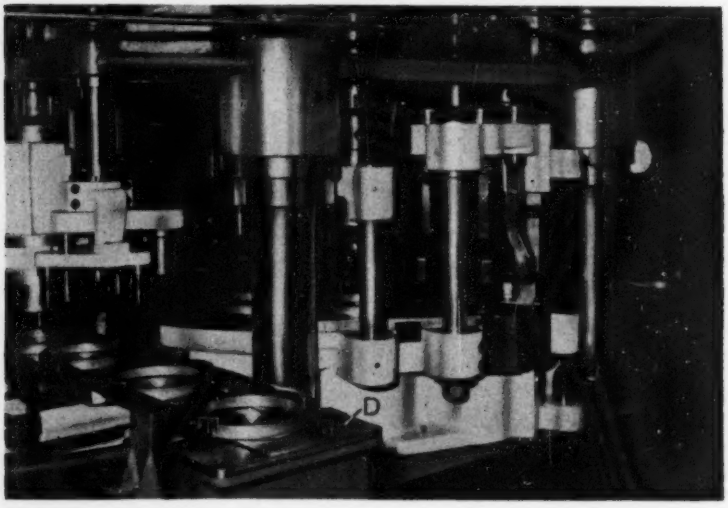


Fig. 3. View of the In-line Transfer Mechanism for Feeding Partially-completed Workpieces to One of the Side Stations on a C.M.B.G. Transfer Press

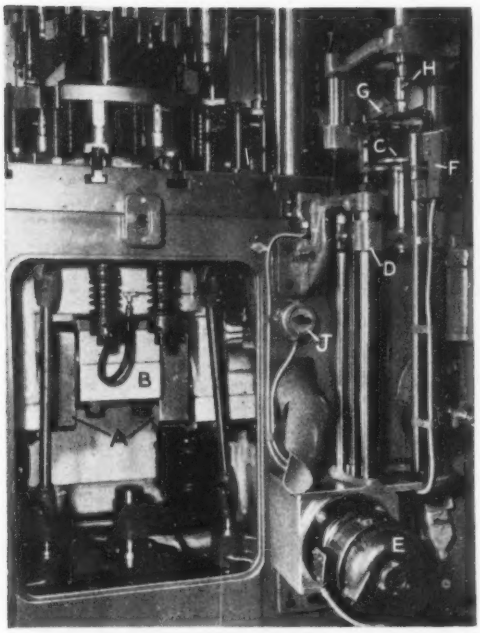


Fig. 4. A Vertical Magazine Unit for Feeding Flat Blanks to One of the Side Stations of a Rotary Transfer Press. The Magazine Elevating Mechanism is Driven by a Separate Motor

To facilitate engagement of the downwardly-projecting lugs, on the yoke, with the uppermost blank, the latter is lifted slightly from the stack by the suction nozzle *H*. This nozzle, it may be observed, is adjustably mounted on a bridge member that projects over the magazine. The complete magazine feed unit may be isolated electrically by means of the switch *J*, and below this switch may be seen the chute, whereby finished workpieces are delivered from the last tool-station.

C.M.B.G. rotary transfer presses are made in a range of sizes with capacities from 16 to 250 tons. The smallest machine in the range is available with 18, 20 or 24 stations, the maximum diameters of the blanks that can be handled being 4$\frac{23}{32}$, 3$\frac{15}{16}$ and 3$\frac{5}{32}$ in., respectively. On this machine the maximum depth that can be drawn is 1$\frac{7}{16}$ in., the ram stroke, 4$\frac{3}{4}$ in., and the maximum open height, 19$\frac{11}{16}$ in. The press can be run at 70 strokes per min., and is driven by a 6-h.p. motor.

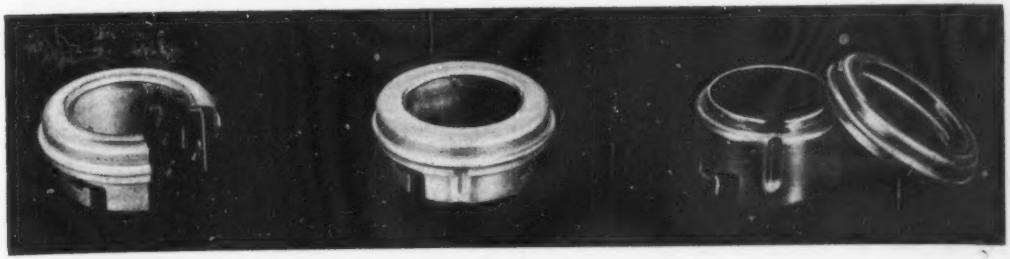
The largest machine can be provided with 10, 12 or 16 stages, and can handle blanks of 12$\frac{13}{32}$, 10$\frac{3}{4}$, and 9$\frac{1}{16}$ in. diameter, respectively. Drawing operations up to a maximum depth of 5$\frac{23}{32}$ in. can be performed, the ram stroke is 15$\frac{3}{4}$ in., and the maximum open height, 35$\frac{7}{8}$ in. The press is driven by a motor of 35 h.p., and runs at 25 strokes per min.

On all presses in the range, two different workpieces can be produced in one cycle, and blanking and drawing are usually carried out at the first operation stage. The method of transfer allows power-driven rotating tools readily to be incorporated, for such operations as knurling, spinning, beading, thread-rolling and trimming, and assembly operations also can be performed. Among the auxiliary equipment available may be noted on- and off-coiling units, coil holders, and scrap-cutters.

TYPICAL OPERATION SEQUENCES

In the article already mentioned, reference was made to the production of a lampholder for a motor-car headlamp. Originally, this component was made by assembling two pressings, which may be seen at the right in Fig. 5. These pressings were made from aluminium strip on a series of single-stage presses and special machines, whereas the single-piece lampholder is made on

Fig. 5. The One-piece Lampholder (seen at the Centre and Left) is Produced on a 250-ton, 18-station C.M.B.G. Rotary Transfer Press and Replaces a Component which was Built-up from the Two Pressings at the Right



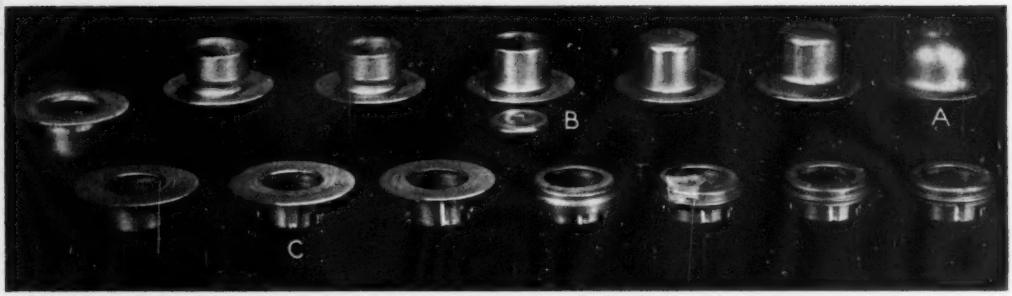


Fig. 6. Stages in the Production of the One-piece Lampholder are Here Indicated. Rotary Trimming and Forming Tools are Employed

an 18-station, 50-ton, C.M.B.G. rotary transfer press. A single-piece lampholder is shown in the centre in Fig. 5, and a second lampholder, at the left, has been partly-sectioned in order that details of the form may be observed. An output rate of 40 lampholders per min. is being maintained, but this rate can be increased to 50 per min., if necessary. Four rotary-spinning operations are performed in the operation sequence on the C.M.B.G. machine, and the workpieces are inverted at a position half-way through the sequence. Only one operator is required to tend the transfer press, and it is stated that the required output can be obtained with one 8-hour shift less than was required for the original method.

Lampholder pressings are shown in Fig. 6, at various stages in the operation sequence, and the cycle starts with blanking and raising, at one of the side tool stations, a pressing after this stage being indicated at *A*. Drawing takes place at the first of the circumferentially-disposed stations, and is followed by setting, after which the closed end is trimmed, as indicated at *B*. Trimming is performed by a rotating cutter, and the pressing is driven by a rotating roller between adjacent stations during the two operations which provide for forming the neck. Next, the pressing is inverted, and the shoulder is "set," before a long indentation is formed and three bayonet-slots are pierced, and a pressing at this stage is seen at *C*.

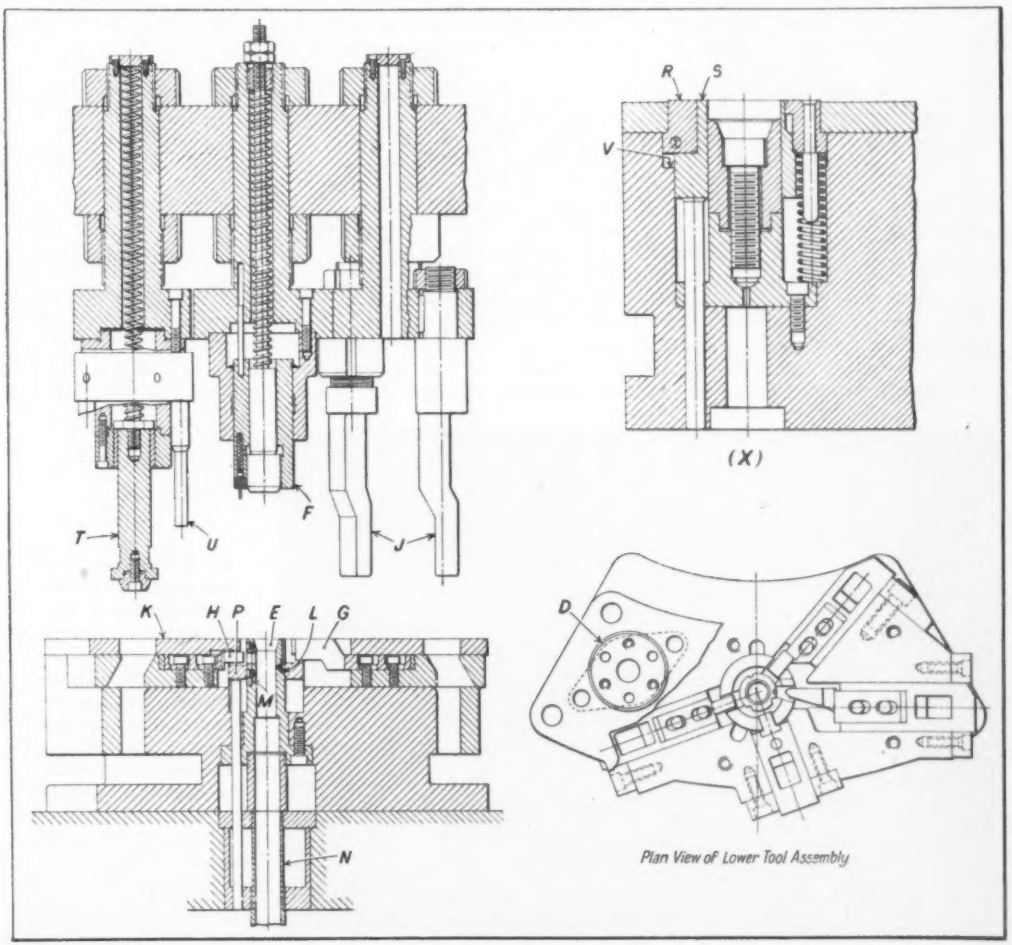
Sectional views of the tooling for producing the indentation and slots, also for the preceding setting operation, are given in Fig. 7. A common cast-iron bolster supports die members for both stages, and the setting die is indicated at *D*, also in the sectional view at *X*. The die assembly for forming the indentation and piercing the slots is indicated at *E*, and the corresponding upper tool at *F*. Punches for indenting and piercing are carried on horizontally-disposed, radial slides in the lower tool, and are indicated at *G* and *H*, respectively. These slides are moved inwards, as the press ram descends, by the action of "dog leg" cams *J*, secured to an adjustable holder, mounted in the upper tool.

For the punching operation, the lampholder pressing is located by means of the die assembly *E*, which is engaged by the tubular portion of the pressing, and by the cover plate *K*, whereon the flange of the pressing rests. The principal member of the die assembly has a half-round groove, into which the metal of the lampholder is pressed by the punch *G* to form the main portion of the indentation. A pocket is machined at the lower end of this groove, and houses a die insert *L*, in which there is a quarter-spherical depression, whereby the lower end of the indentation is formed to the desired shape. There are three further die inserts, one of which is indicated at *M*, and each of these inserts has an aperture of an inverted-L shape, for cutting the bayonet slots in conjunction with the radially-sliding punches. Slugs from the slot-piercing operation pass through the die inserts, and corresponding holes in the main member of the die assembly, thence down the central hole of the latter member, into a tube *N*, whereby they are carried clear of the press. The piercing and forming punches are withdrawn by cam action as the ram of the press rises, and the workpiece is lifted clear of the lower tool assembly, in readiness for transfer, by an ejector ring *P*, which is connected by sliding pins to an air cushion. Spring-loaded pins are incorporated in the upper tool, to prevent the pressing from sticking to the latter assembly.

It will be appreciated that a fairly long ram stroke is necessary for the actuation of the radially-sliding punches by the dog-leg cams. In consequence, the punch member for the preceding "setting" operation is arranged to provide a certain amount of "lost movement." Initially, the

pressing is supported on a spring-loaded pressure ring *R*, and on an ejector *S*, connected to an air cushion, the upper surfaces of these members being flush. As the ram of the press descends, the pressing is centralized by means of the conical location-bung secured to the lower end of the punch *T*. As the downward movement continues, the punch *T* is held in contact with the pressing by its associated compression spring, but is free to move relative to the other upper-tool members. The base of the ejector is of rounded-off diamond shape, and is thrust downwards by two pins *U*, which pass through holes in the cover plate of the lower tool to engage the ends of the ejector, along its major axis. As a result, the workpiece is lowered until its flange rests on the upper face of the pressure ring *R*. Towards the end of the ram movement downwards, the flange of the sliding punch contacts the lower end of the fixed members of the punch assembly, so that the complete assembly is "solid." Then, pressure is transmitted to the workpiece and the pressure ring *R*, to thrust them downwards into the lower tool. This movement continues until the flange of the pressure ring abuts the shoulder face of its seating (as indicated at *V*), and the pressing is planished between the "solid" punch and the upper face of the pressure

Fig. 7. The Tooling for Planishing the Flange, Cutting the Bayonet Slots and Forming an Internal Rib in the One-piece Lampholder



ring, which is then also "solid." When the ram of the press is withdrawn, the sliding punch is freed, and the planished workpiece is lifted with the pressure ring, as the latter is urged upwards by spring pressure. Finally, the ejector S is raised by the action of the air cushion, and the workpiece is lifted clear of the pressure ring, in readiness for the next transfer stage.

PRODUCING TWO DIFFERENT COMPONENTS ON ONE PRESS

In Fig. 8 are shown workpieces at various stages in a production cycle whereby two different pressings are made on a 50-ton Benelli-Gavazzi press, which has 18 circumferentially disposed stations and two side stations. The workpieces are made from coiled brass strip, which is fed by roll-feed units and straighteners to tools at the side stations. One workpiece, indicated at *A* in Fig. 8, is made from 0·036-in. thick material, and the other, seen at *B*, from 0·028 in. material.

Considering first the workpiece *A*, the material is blanked, pierced and drawn at the left-hand side station (as viewed from the front of the press), and a pressing at the end of this stage is indicated at *C*. The pressing is transferred sideways, as described in MACHINERY, 92/615—14/3/58), to the adjacent circumferentially-disposed station. No work is performed at this station, nor at the next two stations to which the workpiece is transferred during successive press cycles. From the third idle station, the workpiece is transferred to a tool at the next station whereby it is coined and a circular rib is formed, as may be seen on the pressing *D*. The coined workpiece is transferred to a piercing and cropping tool at the next station, where location notches are cut in the periphery of the pressing, and two diametrically-opposed pairs of slots are produced. A workpiece after this stage is indicated at *E*. At the next station, the material at the outer long edge of each slot is cropped and bent upwards, so that the opening assumes a shallow T-form, a pressing after this operation being seen at *F*. For this stage, it may be noted, the workpiece is located accurately by means of the previously-cropped notches in the periphery. Finally, the skirt of the pressing is trimmed by a tool at the next station, and the finished workpiece (seen at *A*) is ejected downwards through the lower tool members. The remaining two stations (of the nine in the left- and right-hand quadrants at the front of the machine) are idle.

The blank for the second workpiece (*B*) is cut from the strip and drawn to the shape seen at *G* by a tool at the right-hand side station, and it is transferred sideways to the first of the circumferentially-disposed stations in the right- and left-hand quadrants at the rear of the machine. No work is performed at this station, but at the next, the skirt is trimmed, and a workpiece after this stage is indicated at *H*. A second drawing operation is carried out at the following station, and, at the same time, an annular rib and a circular depression are formed in the closed end of the pressing, as may be seen at *J*. The tool at the next station provides for piercing four

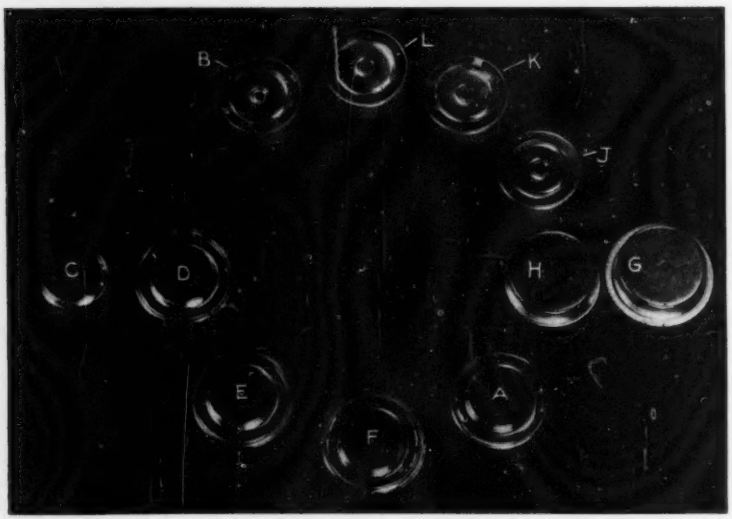


Fig. 8. The Two Pressings *A* and *B* are Produced Simultaneously on a 50-ton, 18-station C.M.B.G. Rotary Transfer Press. Blanking and Drawing Operations are Performed at the Side Stations, and a Rotary Curling Unit is Provided for the Workpiece *B*

windows in the closed end, also a central hole, as may be seen in the pressing at *K*. Scrap material from the piercing operations passes upwards through the top tool and is discharged by way of a chute. The adjoining station is idle, and, at the following tool position, the lugs that project into each window opening are bent downwards, and the metal round the central hole is plunged. A workpiece at the end of this stage is indicated at *L*. A further idle station follows, and then the open end of the pressing is spun inwards by means of the tools shown in Fig. 9.

In the spinning tool there is a work-mandrel *M* which is in line with the upper tool members. This mandrel is surrounded by a spring-loaded annular pad (not shown), whereon the workpiece is deposited by the transfer fingers. The mandrel is carried in taper-roller bearings, and is driven from an electric motor mounted beneath the lower tool. At one side of the lower-tool body is pivoted a housing for the spinning mandrel *N*. This mandrel carries a Celeron gear *P* which meshes with a steel gear on the work-mandrel *M*, and the housing for the spinning mandrel is arranged to pivot about a horizontal axis which coincides with the intersection of the axis of the spinning mandrel and the central plane of the gear mounted thereon. The backlash in the gears is such that the spinning mandrel can be inclined about the pivoting axis, through a small angle, without binding.

The spinning mandrel is mounted in tapered roller bearings, and carries two discs, *R* and *S*, at its upper end. Between the discs there is a thick rubber bush *T*, and a steel sleeve *U*. A pair of lugs projects upwards from the housing and each lug carries a roller *V* at its upper end.

As the upper tool assembly is moved downwards, the workpiece is aligned with the work-mandrel *M* by four fingers *W*, and, as the downwards movement continues, these fingers depress the support pad (not shown) against spring pressure, so that the workpiece is loaded over the mandrel. Then, during further movement, the spring-loaded ejector plunger *X* contacts the upper surface of the workpiece, and is held stationary while the other members of the upper tool assembly descend. The ejector plunger is housed within a sliding pressure pad assembly, *Z*, which is also spring loaded, and during the final stages of the downward movement this pad contacts the workpiece and holds it firmly on the work-mandrel.

During the course of the movements described, the cam plate *Y* engages the roller *V*, with the result that the spinning mandrel assembly is swung inwards towards the workpiece. The disc *R* passes over the upper surface of the workpiece

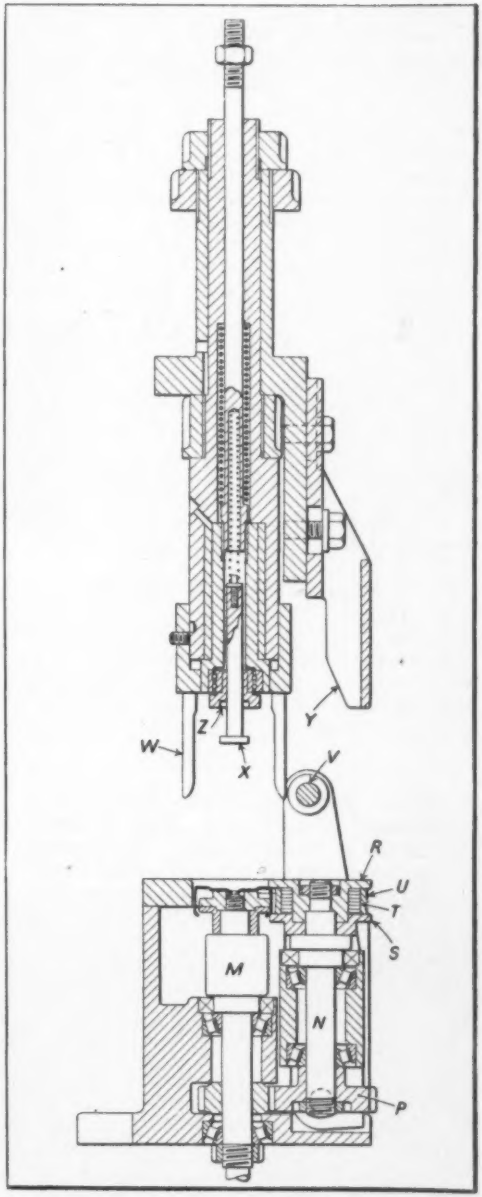


Fig. 9. The Rotary Forming Unit for Curling Inwards the Open End of the Pressing *B*, Fig. 8. The Curling Spindle is Fed Inwards Towards the Driven Work-support Mandrel by a Cam-plate on the Upper Tool Assembly

and supports it against the upward force exerted during the spinning operation. The lower edge of the workpiece is engaged by the rotating disc *S*, and this edge is curled over as the disc moves inwards. At the same time, the side of the workpiece is gripped between the flanges on the mandrel *M* and by the sleeve *U*, so that the drive is transmitted without slip, the rubber bush *T* allowing the sleeve to move sideways during the angular motion of the mandrel *N*.

When the upper tool assembly is withdrawn at the end of the pressing cycle, the spinning mandrel is returned by the action of a spring, and the workpiece is lifted clear of the mandrel *M* by the spring-loaded pad in the lower tool. Any tendency for the workpiece to adhere to the pressure pad *Z*, due, for example, to the oil film on the surfaces of the metal, is counteracted by the thrust applied by the ejector *X*. The workpiece is removed from the spring-loaded pad, at the end of the operation cycle, by the transfer fingers, and is delivered to an idle station, whence it is transferred to the last station at the rear of the machine, where it is thrust downwards into a chute.

PRODUCING HEADLAMP PRESSINGS

Various stages in the production of headlamp bodies, on a 130-ton, 11-station rotary transfer press, are shown in Fig. 10. The first operation provides for cutting a blank from steel strip and drawing it to the shape indicated at *A*, this stage being performed at one of the side stations. Next, the drawn pressing is transferred to the adjacent circumferentially-disposed station, which is idle. From this idle station, the pressing passes through a series of tools at the stations at the rear of the press, and is subjected to six stretch-drawing operations to bring it to the shape indicated at *B*. The tools are designed so that the flange of the pressing is gripped between pressure rings in the upper and lower tool-assemblies, and thrust is applied to these rings by means of air cushions in the base and crown of the press. In this way, a constant gripping force is exerted while the pressing is pulled downwards over a stationary punch. The flow of metal is controlled by means of draw beads, and a large number of pressing stages is employed to ensure a high quality finish on the work-surfaces, so that chromium plating can be carried out subsequently without further polishing. It may be of interest to note that the height of the pressing after the final drawing stage is 1½ times the diameter.

After the final drawing stage, excess metal is trimmed from the flange of the workpiece by a punch and die at the next station, and the waste material is cut into two pieces, by chisel-shaped blades, for easy disposal. A workpiece at the end of this trimming stage is indicated at *C*. At the next station, a rotary spinning tool is applied to form a groove in the periphery, as seen in the pressing at *D*. This groove-spinning operation is necessary to produce the smaller register diameter and shoulder at the large end of the headlamp housing, whereon the rim is subsequently fitted. Finally, a second rotary tool, at the next station, is employed to trim the excess material from the large end of the pressing to leave the reduced register diameter, and a trimmed pressing is shown at *E*, with the annular scrap below it.

A view of the tooling area of the press is given

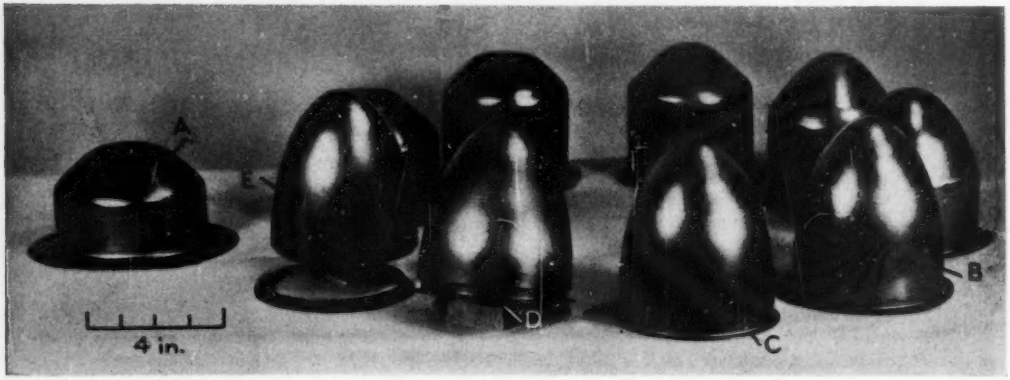


Fig. 10. Various Stages in the Production of Steel Headlamp Housings on a 130-ton, 11-station C.M.B.G. Press are Here Shown. Seven Drawing Stages are Employed to Ensure a Good Surface Finish, and Rotary Trimming and Forming Tools are Provided

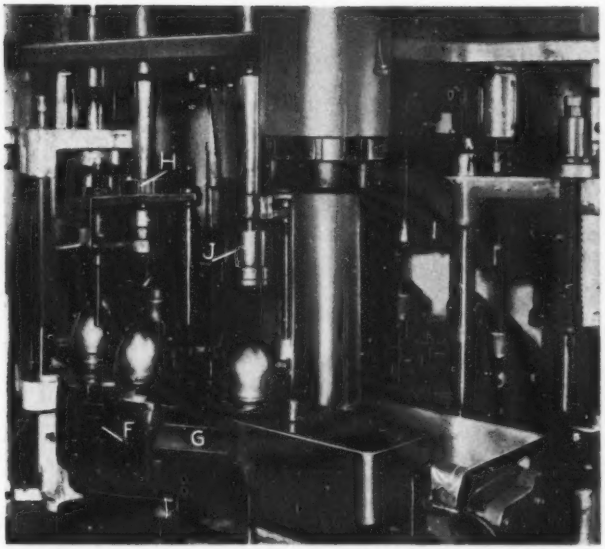


Fig. 11. Close-up View of the Tooling for the Production of the Headlamp Pressing, Fig. 10, Showing the Rotary Forming and Trimming Tools at the Left

in Fig. 11, and the rotary spinning tool may be seen at *F*, the trimming tool being obscured by the guard *G*. Attention is drawn to the steady members *H* and *J*, which are connected to air cylinders mounted above the press ram. These cylinders can be advanced rapidly as the ram is descending, and support the workpiece well before the ram reaches the bottom of its stroke. With the work supported in this way, the spinning and trimming operations can be initiated, independently of the ram position. From the trimming station, the workpiece and scrap material are blown sideways, by a blast of compressed air, as the ram ascends. The transfer mechanism, it may be pointed out, is provided with Celeron gripper fingers to avoid marking the work.

A somewhat similar series of operations is employed for the production of aluminium cooking utensils by an Italian company, and is illustrated by the pressings shown in Fig. 12. In this instance, a 130-ton, 11-station C.M.B.G. press is used, but pressing operations are performed at six stations only. Aluminium strip, 1½ mm. (0·060 in.) thick, is blanked and cupped at one of the side stations, and, after it has been transferred to the circumferentially-disposed stations, is subjected to two stretch-drawing operations. Pressings after these three stages are seen at *A*, *B* and *C*, respectively. After the second drawing operation, the body of the workpiece is of the desired form, and, next, the flange is pinch-trimmed, as indicated at *D*, leaving enough metal to form a bead. At the following stage, the trimmed flange is curled upwards by means of a rotary spinning tool, and a pressing after this operation is seen at *E*. Finally, the flange is curled over to form a bead by a second spinning tool at the next station, and a completed pressing is seen at *F*.

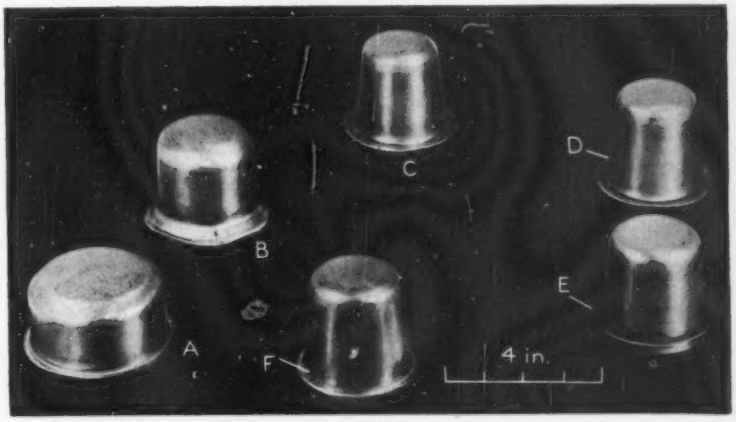


Fig. 12. Various Stages in the Production of Aluminium Cooking Utensils on a 130-ton C.M.B.G. Press are Here Indicated. Only Six of the Eleven Stations Available on the Machine are Used

COUNTERSINKING AND MARKING MACHINE

As has already been intimated, Benelli Gavazzi do not confine their activities solely to the production of rotary transfer presses, and the company has recently built a machine for countersinking and marking union nuts for the British Ermeto Corporation, Ltd., Beacon Works, Hargrave Road, Maidenhead, Berks. The machine is shown in Fig. 13, and incorporates units from the company's rotary and in-line transfer presses. The nuts are produced on single-spindle or multi-spindle automatics, and the tooling on these machines provides for countersinking one end only.

A standard circular transporter, with an oil-immersed Geneva mechanism, from a rotary transfer press, is mounted on the cabinet-type base. The base houses a crankshaft, to which drive is transmitted from a 3-h.p. motor and primary V-belt reduction, at one side, through a P.I.V. gear. A cross-head and column assembly from a small in-line press is mounted at the rear of the base and is coupled to the crankshaft. The cross-head is provided with auxiliary compensating pneumatic rams, and carries two work-support members, one of which (indicated at *A*) is connected to an air cylinder *B*. A plunger *C* is adjustably mounted on the cross-head, and is machined at its lower end to provide a number of angularly-disposed facets, which serve to actuate the gripper jaws.

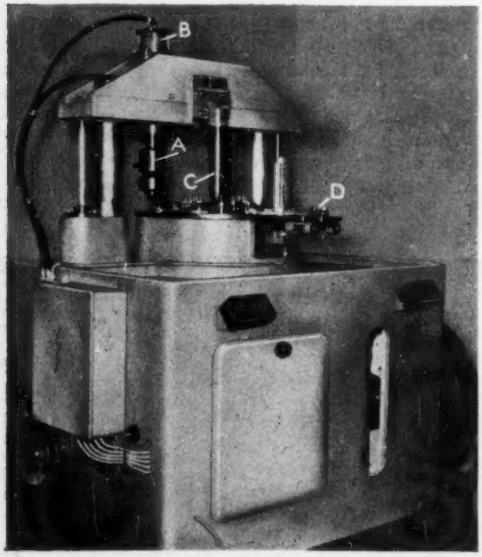


Fig. 13. This Countersinking and Marking Machine has Been Built by Benelli-Gavazzi and Incorporates Standard Units from the Company's Rotary and In-line Transfer Presses

At the front of the circular transporter is mounted a feed slide and vertical magazine chute. The feed slide, indicated at *D*, is coupled to an air cylinder and is advanced and withdrawn during each press cycle. During its forward movement, it carries the lowermost nut, from the stack in the magazine chute, to a position between the gripper jaws of the rotary transfer mechanism. A spring-loaded catch is fitted to retain the nut in this position when the slide is withdrawn. During successive cycles of the press, the nut is advanced round the table to the station beneath the support member *B*.

This station may be seen at the right in Fig. 14, which is a close-up view of the working area, from the rear. As the cross-head is moved downwards, the facets on the end of the plunger *C* cause the gripper fingers to open, so that the workpiece is released, and it is engaged by the female adapter on the end of the member *B*, which aligns it accurately with the drill *E*. This drill has a point of 90 deg. included angle, and it is advanced through a hole in the circular table *F* by a pneumatically-operated mechanism. The drill produces a countersink in the lower end of the component, and, due to its inverted mounting, the swarf produced falls clear of the work.

From the countersinking station, the workpiece is carried, through a number of idle stations, to a position beneath the second support-member *G*. This member is located above a holder wherein can be fitted number and letter stamps, also a stamp to produce the company's trade mark. As the cross-head of the machine is moved downwards, the nut is thrust by the support member *G* into contact with the stamps, so that the corresponding impressions are formed in its lower end face. It will be recalled that the support member *B*, for the countersinking station, is coupled to an air cylinder. This arrangement allows the member *B* to advance and hold a workpiece against the table, in opposition to the upward thrust of the drill before the cross-head approaches the end of its downward movement. In this way, the drilling and stamping operations can be completely "overlapped." Countersunk and stamped nuts are carried round the circular table to a station adjacent to the loading position. Here, there is a hole which communicates with a chute, and each nut is dropped through this hole when the associated gripper jaws are opened. The nut then falls down the chute into a work-pan.

Both work-support members are adjustable vertically, and are fitted with replaceable ends to

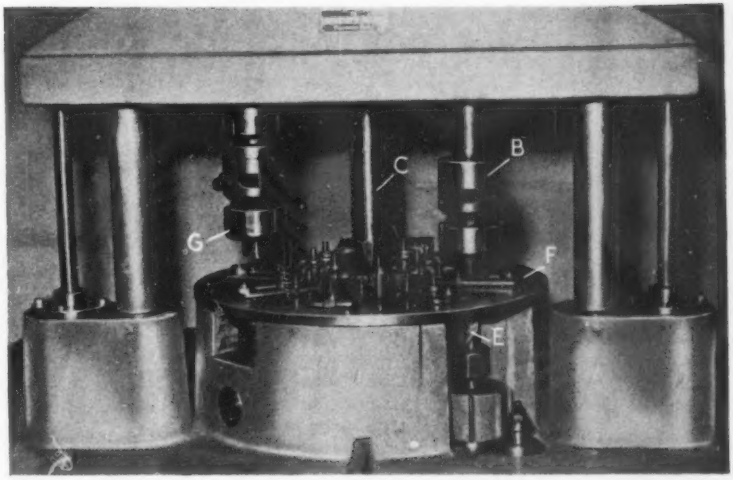


Fig. 14. Close-up View of the Countersinking and Marking Machine from the Rear, Showing the Rotary Transfer Mechanism, the Cutter Spindle, and the Marking Station

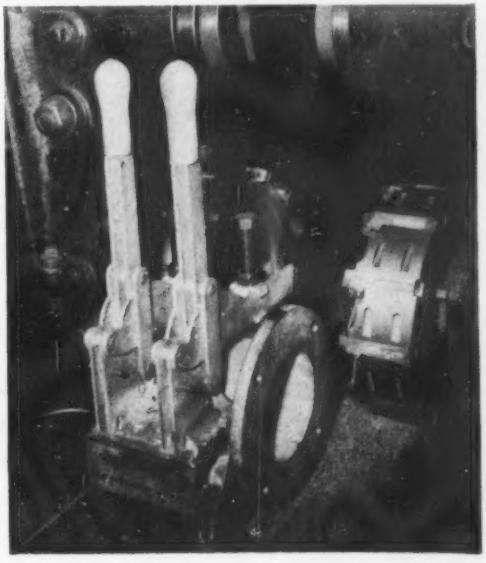
suit different workpieces. Three sets of gripper fingers are provided, and the machine will accommodate hexagon nuts measuring 0·710, 1·67 and 2·75 in. across flats, the sizes of the holes to be countersunk being ¼, 1 and 2 in. respectively. The machine will operate at a maximum rate of 1 nut per sec., but it is used at a slower rate, governed by the speed at which nuts can be loaded into the magazine chute by the operator. Hitherto, the countersinking and stamping operations kept five workpeople employed full time. Machines of a similar type can be supplied with a probing device to detect whether or not the nuts have been loaded with the large end downwards, and a re-orientating unit to invert any nuts that have not been correctly loaded, but these accessories were not considered necessary in this instance.

Straddle Milling Operation with Throw-away Insert Cutters

For machining the 9-in. diameter faces on cast-iron hopper base extensions, the straddle milling set-up on a Cincinnati machine, shown in the figure, is now employed at the works of Auburn Foundries, Inc., Heating Division, Auburn, Ind., U.S.A. Previously, these components were faced on turret lathes, with brazed-tip carbide tools, and it is stated that the change of method has enabled the floor-to-floor time to be reduced from 26 min. to 5 min., and the tool cost per casting from 4·7 cents to 3·7 cents.

Two "Odd Job" face Kennamills, supplied by Kennametal Inc., Latrobe, Pa., U.S.A., are employed for the operation, each of which is equipped with 12 type KSB-12 Kendex tools with grade K6 square "turn-over" inserts.

The depth of cut is ¼ in., and the faces are milled at a speed of 300 surface ft. per min. and a feed of 7 in. per min. With the eight sets of cutting edges provided by the inserts, a total of 1,200 pieces can be faced.



Set-up for Straddle Milling an Iron Casting. Each of the Cutters is Equipped with 12 Standard Tool-holders with Throw-away Carbide Tips

Mercer Airmatic Automatic Sizing Equipment

In an earlier article in MACHINERY, 89/730—28/9/56, reference was made to the development programme of Thomas Mercer (Air Gauges), Ltd., Eywood Road, St. Albans, Herts., directed towards extending the range of applications for their air gauging system. An important outcome of this work was the introduction of a highly sensitive pressure-operated switch, incorporating electrical contacts actuated by a Bourdon tube. This type of switch is intended for use with air gauging equipment, and, in accordance with modern trends, provides for the following: control of visual or other signals for high production inspection set-ups; operation of selector mechanisms in automatic or semi-automatic checking, grading or sorting equipment; and automatic control of machine motions. An electronic relay system, incorporating a cold-cathode starting circuit, was also developed, to amplify the primary signals from the switches, and thus to provide the necessary current for any of the above functions.

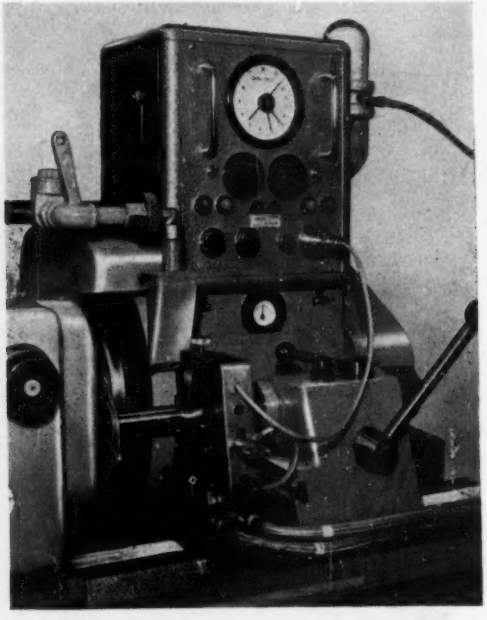


Fig. 1. Mercer Mark I Airmatic Automatic Sizing Equipment, Set Up on a Karstens Grinding Machine in the Company's Works

Developments in this field have continued, as a result of which the company has introduced air gauging equipment for the automatic control of grinding machines, known as the Mercer Airmatic Sizer. This unit, which is to be shown for the first time at the Production Exhibition at Olympia, is available in four types, designated Mark I, II, III, and IV. A typical installation of the Mark I unit, in the company's works, on a Karstens cylindrical grinder (Elgar Machine Tool Co., Ltd.), is shown in Fig. 1. This unit, which is basically the simplest of the four types, provides for 2-stage control of the grinding head in-feed. One signal stops the in-feed motion at the required stage, and the second withdraws the head as soon as the work reaches a predetermined finished size.

The necessary pressure variations in the pneumatic system are derived from a caliper-type, mechanical contact, gauging head, also seen in Fig. 1, which is mounted on a hydraulically-operated slide coupled to the hydraulic system of the machine. This slide is arranged to advance the head automatically into engagement with the work at the beginning of the grinding cycle, and to retract it in unison with the wheel-head when the cycle has been completed. A trip-valve, incorporated in the base, actuates an auxiliary hydraulic cylinder, which opens the gauging jaws during the advance of the head, and allows them to close on to the work once it has reached the fully-advanced position. This opening action also takes place on withdrawal.

A close-up view of the gauging head, with the cover removed to show details of the design, is given in Fig. 2. Each caliper jaw assembly is provided with a carbide contact, and is carried on a pair of flat suspension springs. A Microjet plunger unit is attached to the lower jaw assembly by a pair of vertical pillars, in such a manner that the contact tip engages a pad on the upper assembly, and is coupled to the controller. Each jaw is independently adjustable in relation to the suspension system and the Microjet unit, and for the particular head seen, the working range is from $\frac{3}{16}$ to 1⅜ in. diameter.

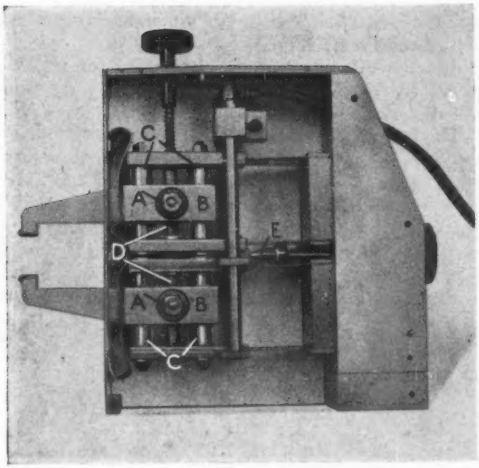


Fig. 2. Caliper-type Air Gauging Head, with Cover Removed, Showing Details of the Jaw Suspension System and Independent Adjustment

To effect adjustment, the lock nuts *A* are slackened, thereby releasing the clamping bars *B* from the guide pillars *C*, and the screws *D* are rotated by means of the knurled knob seen at the top of the housing. When it is required to adjust the upper jaw, the knob is pulled upwards, and a key on the stem is thereby engaged with the upper screw. Similarly, for adjusting the lower jaw, the knob is pushed downwards. Once the settings have been made, the clamp bars are again tightened. With this arrangement, it is ensured that the accuracy and permanence of the settings is not dependent in any way on the accuracy or freedom from backlash of the screws. This adjustment provides not only for diameter setting, but also for setting to the centre height of the work, and varying the contact pressure of the jaws. Opening and closure of the jaws, during advance and retraction, is effected by means of the conical member *E*, which is actuated by the auxiliary hydraulic cylinder already mentioned. Access to the nuts *A* is through a small door in the cover.

Referring again to Fig. 1, it will be observed that the controller is of compact proportions. It is 13 in. high, 11 in. wide, and 9½ in. deep, and incorporates a standard 4-in., 0·002-in. range, indicating dial, with a widely-spaced centre-zero scale, which gives readings directly to 0·0001 in. Provided with adjustable limit pointers, this instrument is used mainly for reference purposes when zero-setting, also when setting the magnification and the two pressure switches. The control knobs for the latter are seen immediately below the indicating instrument, and are of a dial type, which may be calibrated, if required, to facilitate the repetition of the settings. The pressure switch at the left controls the point of in-feed cut-off, and the switch at the right, the withdrawal of the wheel-head. The indicator is effective throughout the working cycle, so that the size of the work, at the points at which the switches operate, can readily be ascertained.

Associated with each pressure switch, there is a red and a green signal lamp. Illumination of a red lamp indicates "electrical circuit alive," and green, "function in progress." In the centre, between the pairs of signal lamps, there are two fuses, and on either side of the pressure switch controls there is a tumbler-switch. The switch at the left is for selecting "manual" or "automatic" operation. With the "manual" setting, the wheel-head is fed in by hand, and retracts automatically when the work reaches a predetermined size. When the equipment is used in this way, the withdrawal motion is initiated by a micro-switch, actuated by an adjustable trip on the handwheel. The second switch, to the right of the pressure switch controls, provides for mains supply "on" and "off." The controls at the bottom of the panel are those normally employed with Mercer air gauging equipment, and comprise, from left to right, the control orifice, for adjusting magnification; the bleed to atmosphere, for zero setting; and a cut-off valve, for isolating the dial instrument.

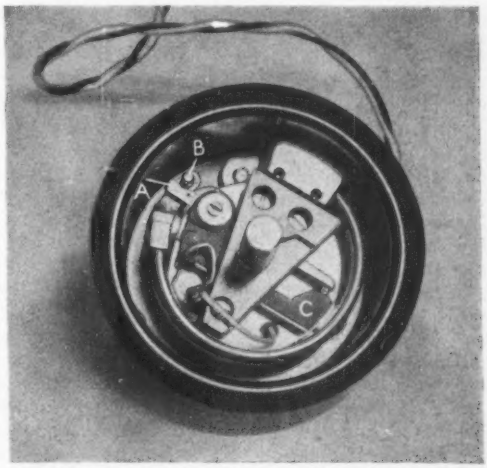


Fig. 3. The Latest Type of Bourdon-tube Pressure Switch is of Compact Design, with a Housing of Only 2 in. Diameter. Setting is Effected by Means of a Cam

Since the earlier article was written, development work on the design of the pressure switches has also continued, and they are now of the compact form shown in Fig. 3, with a housing of only 2 in. diameter. To ensure that the recovery of the Bourdon tube is not restrained by the closure of the contacts, the lever-arm *A* of the movable contact is engaged on one side only, by the pin *B*, which is mounted on the free end of the tube. The lever, which provides a 4:1 amplification ratio, is very lightly spring loaded, to maintain contact with the pin *B*.

The second switch contact is mounted on an insulating arm *C*, which is arranged to pivot about the same centre as the lever-arm *A*, and is also spring loaded. Adjustment of the setting is effected by rotating a cam integral with the central spindle. This spindle is mounted in a split bearing, also of insulating material, whereby the friction on the spindle is readily adjustable. The sensitivity of these switches is such that, under suitable conditions, the control equipment is capable of discrimination to 0·00002–0·00003 in.

The equipment described incorporates an electronic relay system, wtih a cold-cathode starting circuit, of the type earlier mentioned, which does not require to be warmed up for stabilization after being switched on. This system provides two current supplies, both of which are controlled by the pressure switches. One is of low voltage, for operating the signal lamps, and the other, of any mains voltage up to 255 A.C., for machine control. Alternatively, the latter supply may be the same as that provided for the machine.

The Airmatic Mark III equipment is generally similar to the Mark I, except that it is a 3-stage unit, for use on machines where the automatic cycle provides for rapid in-feed, slow in-feed, and withdrawal. There are, therefore, three pressure switches, and three pairs of signal lamps. A further development by the company is incorporated in the Mark II and IV controllers, which are of a differential type. These units have a dual pneumatic system and incorporate differential pressure switches of special design, both of which are the subject of a provisional patent application. They are intended for the sizing of cylindrical components, which are required to be a matched fit in bores already machined.

This type of equipment is used with a caliper head, also a bore-gauging mandrel for insertion in the hole to which the work is to be matched. The latter sets the system in such a manner that a controlled differential between the diameter of the work and that of the bore is automatically maintained. This differential is readily adjustable, to very close tolerances, by means of the pressure switches, so that consistent, accurately-controlled fits can be obtained in bores that differ widely within the tolerance range. The need for grading of the workpieces, and selective assembly are thus avoided.

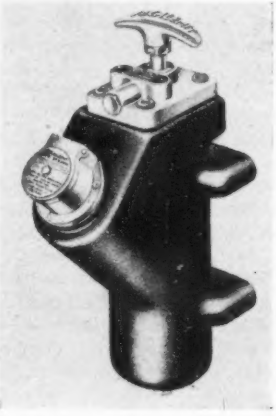
The Mark II and Mark IV differential units correspond to the Mark I and III units, in that they provide for 2- and 3-stage control. Each type incorporates two indicating instruments, which, again, are provided mainly for setting and reference purposes. One instrument corresponds to the bore gauging mandrel, and the other to the caliper head, so that the difference between work diameter and bore diameter may readily be ascertained at any time. This equipment, also, is capable of discrimination of the order of 0·00003 in. It is pointed out that, whereas the differential system was developed primarily for the automatic sizing equipment described, it could be applied just as effectively, for example, to inspection equipment of the comparator type.

Tecalemit Hand-operated Bijur Lubricator

The K type hand-operated lubricating pump, made by Tecalemit, Ltd., Plymouth, Devon, can now be supplied in a specially designed reservoir, as shown in the figure, and this unit is particularly intended for application to fork-lift trucks, machine tools, and textile machinery. It will be observed that the unit is designed for external mounting.

The K-type pump is operated by raising and releasing the T-handle, which is returned by a spring, and oil is then automatically discharged throughout the system under a pressure of 70 lb. per sq. in.

Output can be adjusted up to a maximum of 7·5 c.c. with a 1·5-in. stroke. The reservoir has an oil capacity of approximately ⅝ of a pint.



Tecalemit Hand-operated Bijur Lubricator for External Mounting

Hand-tool Production in a Swedish Factory

Some Examples of Methods Employed by E. A. Bergs Fabriks A-B., Eskilstuna

The firm of E. A. Bergs Fabriks A-B., Eskilstuna, Sweden, was founded in 1880, and was originally concerned exclusively with the manufacture of razors. Since that time, the range of their products has considerably increased, and now includes pliers, clippers, shears, and knives of all descriptions, also wood-working tools such as chisels and plane-irons. In order to meet the requirements of individual countries in a world-wide export market —particularly in the cutlery field—their products are necessarily highly diversified. The modern factory provides employment for approximately 350 people, and a high output is maintained by the use of efficient methods, involving the extensive application of mechanical handling aids. A high proportion of this handling equipment is of the firm's own design and construction.

All raw material is subject to laboratory control, and in the materials stores, all stock is of a uniform economical length, convenient for handling. Bar stock, for tools, such as pliers and chisels, is loaded vertically into racks, which are transferred to the forging shop by means of fork trucks. Extensive use, it may be noted, is made of Yale & Towne fork trucks throughout the factory. Flat stock, for example for knives and plane-irons, is placed in cradles in which it is handled horizontally, by means of a rail hoist. The material stores are adjacent to the blanking shop, and one end of the cradle is inserted through an opening in the dividing wall. In the blanking shop, the stock is pulled endwise off the cradle on to a large table, at the same level as the bolsters of the presses, on to which it is drawn directly.

The equipment of the shop includes a crank-type power press, of 50 tons capacity, which is used for producing large knife-blanks. Carbon-steel press-tools are used for the larger blanks, and Stellite-faced tools for the smaller sizes. In the forging shop, the machines are installed on either side of a central gangway, in which there is a continuous steel-strip conveyor, set level with the shop floor. This conveyor serves to transfer the forgings, loaded in steel boxes, to a marshalling and buffer storage area at the delivery end of the shop.

A typical station in the forging shop, one of which is shown in Fig. 1, comprises a board-hammer, a high-speed hammer, a crank-press, and a small oil-fired furnace. The majority of the board-hammers are by Bolinder (Swedish) and the high-speed hammers, which are of the crank-driven oscillating leaf-spring type seen in Fig. 1, are mainly of the firm's own design and construction. Each group of machines is tended by one operator, and the bar stock is delivered to the station in one of the vertical racks mentioned earlier. After heating the stock, the operator prepares the "use" under the high-speed hammer, forges it under the board-hammer, and trims it on the crank-press, with Stellite-faced tools. For most of the work handled, these stages are completed in one heat, and the operator must, therefore, work as rapidly as possible.

To reduce the time required for periodically tightening the wedges which secure the dies, the high-speed pneumatic hammer shown in use in

Fig. 1. A Typical Station in the Forging Shop, Showing (right) One of the High-speed Hammers Designed and Built by the Company

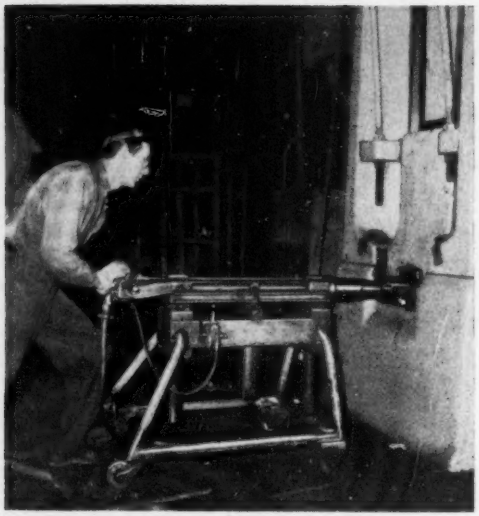


Fig. 2. A Pneumatic Hammer, Mounted on a Trolley as Here Shown, Facilitates Routine Tightening of the Wedges Securing the Dies on the Board Hammers

Fig. 2 is employed. Mounted on a wheeled trolley, it can readily be moved to any desired point in the shop. Of a standard type, the hammer was adapted for this purpose by the company. Normally, it is used by the operators of the forging-hammers.

The marshalling area at the delivery end of the shop comprises a series of roller tracks, at floor level, one of which forms a continuation of the central conveyor band. The remainder are arranged at right-angles to it, and deliver on to another section, parallel with the first. With this arrangement, the steel boxes of stampings are conveniently disposed, and can be withdrawn in any desired sequence, with a minimum of handling effort. When they have cooled sufficiently, the raw stampings are transferred to a stores, whence they are re-issued to the various sections.

ANNEALING

Stampings are annealed in 30-kW. temperature-controlled electric furnaces, designed and built by the company, some of which are shown in Fig. 3. The components are stacked in open cradles, on special pallets, at floor-level, and the loaded pallets are placed on stands arranged across the front of the line of furnaces. These pallets have skid-rails along which the cradles are moved with the aid of a long-handled, two-prong, fork-shaped hand-tool. The prongs of this tool are curved on the underside, so that they can be rocked, to facilitate insertion beneath a loaded cradle. With the aid of this tool, each cradle, in turn, is slid along the rails, on to a turntable in front of a furnace. Here, it is turned through 90 deg., and then pushed into the furnace. To facilitate handling the loaded pallets, the company make use of a Newton Hydra-truck lifting trolley which is seen in Fig. 3. The lifting platform of this unit is raised and lowered by means of a hydraulic ram, supplied by a hand-operated pump, and the rear wheels are full castering, so that the turning circle is small.

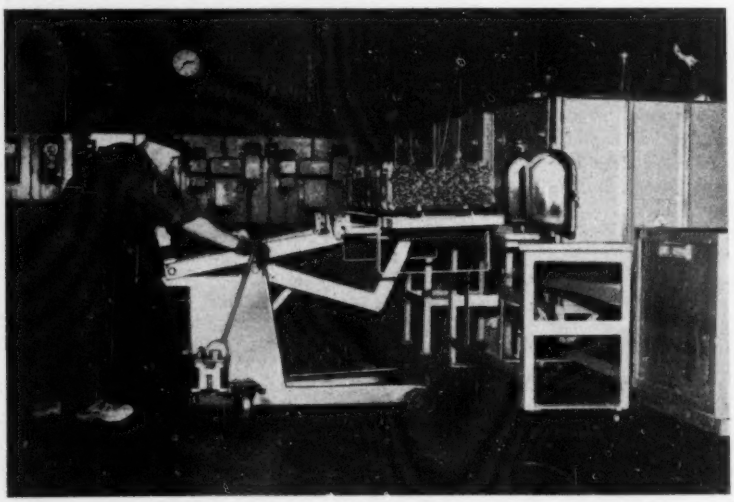


Fig. 3. The Newton Hydratruck Lifting-trolley, Here Shown, is Employed by the Company to Facilitate Loading Forgings into Electric Annealing Furnaces, of the Firm's Own Design and Construction

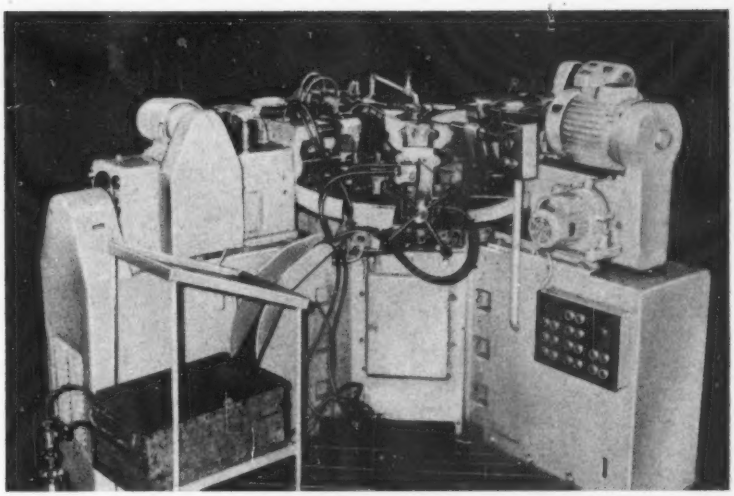


Fig. 4. Special-purpose, Multi-station, Rotary-head Machines, of the Type Here Shown, are Employed for Facing and Drilling Operations on "Pivoted" Tools

MACHINING

The equipment of the machine-shop devoted to "pivoted" tools, such as pliers and shears, includes special-purpose multi-station rotary-head machines of the type shown in Fig. 4, which were also designed and built by the company. These machines are employed for such operations as drilling and counterboring the pivot-pin holes, and facing the mating and outer surfaces on the stampings. The particular example illustrated has eight work stations, provided with pneumatic clamping equipment, and the four cutter-heads have air-hydraulic feed-motions. Should the machine be required to perform a larger number of operations, three additional heads can be fitted. A typical performance for these machines is 300 to 400 components per hour.

Inner and outer jaw-profiles on components for such tools as pliers are usually milled on horizontal machines, four to six of which are tended by each operator. At a typical set-up on an Olivetti FP.4 machine, shown in Fig. 5, four components are machined at a time, on the internal and external profiles, in two passes. Two form-cutters are employed, one for the external, and the other for the internal profile, and are mounted on either side of a central arbor support. Two vices are mounted on the table, in line with each cutter, and the jaws of each vice are recessed to locate two components at a time. At the first pass, components on one side are machined internally and those on the other externally, and they are transposed for the second pass. The vices are spaced sufficiently far apart to enable loading, transposing, and unloading to be carried out while milling is in progress. At this set up, the cutters are run at a surface-speed of 164 ft. per min., with a feed of 2 in. per min., and 100 pairs of components are milled per hour.

At another milling set-up, shown in Fig. 6, the diamond-pattern serrations are milled on the gripping faces of 400 plier-jaws an hour. The work is held in the profiled jaws of a two-position, indexing vice, operated by a diaphragm type, air cylinder, which is controlled by means of a pedal. Depression of the pedal, to open the jaws, also releases the index locking mechanism. Indexing is performed manually, and each component is

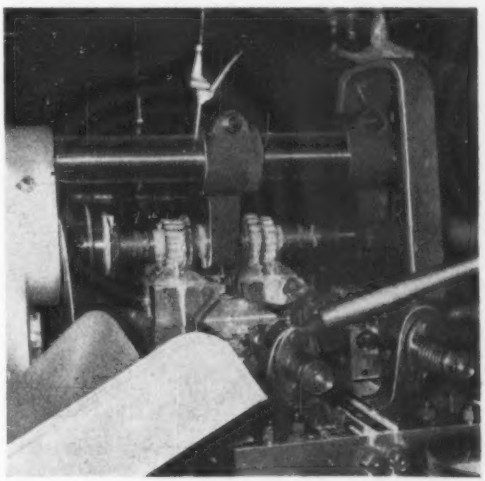


Fig. 5. At This Shuttle-milling Set-up on a Type FP.4 Olivetti Machine, 100 Pairs of Plier Components are Profiled per Hour

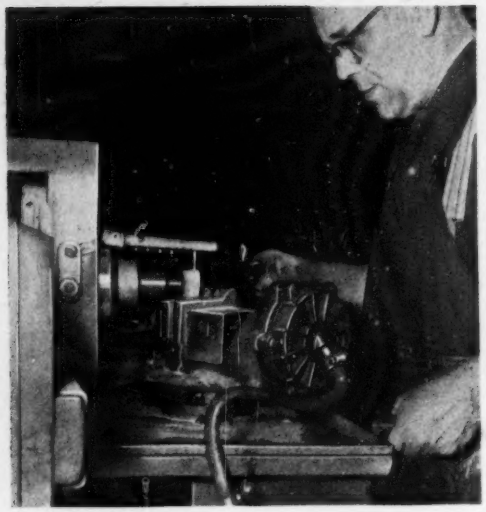


Fig. 6. At This Simple Set-up, Incorporating an Air-operated Indexing Vice, the Diamond-pattern Serrations are Milled on 400 Plier Components per Hour

machined in two passes, one at each index position. The table is traversed by hand.

Many of the bench-vices employed in the assembly section of the factory have been converted for pneumatic operation, and a typical example is shown in Fig. 7. Here, an operator

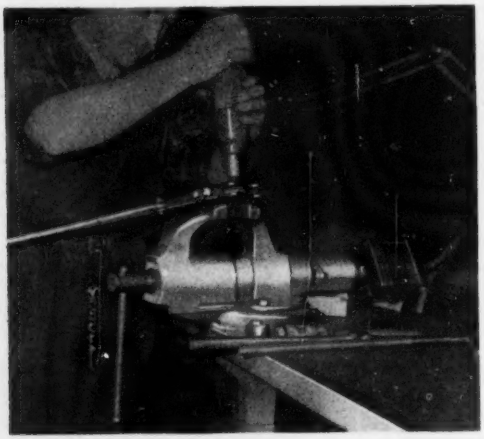


Fig. 7. This Air-operated Bench-vice is Pedal Controlled so that the Operator's Hands are Free

is seen assembling the pivot-bolt of a pair of bolt-cropping shears, with the aid of a power runner. An air-cylinder is attached to the body of the vice, and the clamping-screw nut is coupled to the ram. The opening of the jaws may thus be altered by means of the vice handle, in the normal manner. Air supply to the cylinder is controlled by a pedal, so that both the operator's hands are left free for manipulating the work.

The hardening of small pivoted tools such as pliers, clippers and wire-cutters, is performed in a separate section, where the jaws are heated by immersing them in a bath of molten lead. The temperature of the bath is automatically controlled, and the surface is covered with a layer of carbon chips, to minimize oxidation. Supplied by Honeywell-Brown, Ltd., the temperature-control equipment incorporates a process-timer which indicates the completion of the heating period by means of a signal-lamp, and the work is then quenched in an oil-bath. While the lamp is still illuminated, the next batch of components is placed in the lead bath, and shortly afterwards, the lamp is automatically extinguished. When it is again illuminated, the next batch is quenched. The length of time that the lamp remains extinguished is adjustable, to suit work requiring different heating periods.

TESTING

Tools, such as wire-cutters and clippers, are carefully checked for accuracy of the cutting edges by tests on fine insulated wire, and on paper, and adjustments are made, if necessary so that these materials are cleanly cut. All such cutting tools are subjected to a test on plain wire, for which the rig shown in Fig. 8 is employed. A pair of profiled jaws is mounted horizontally on the top of the bench, one of which is moveable, and coupled to a pedal-controlled air-cylinder. The tool to be tested is placed between the jaws, and steel or piano-wire is placed between the cutting edges. When the pedal is depressed, the profiled jaws squeeze the handles of the tool, so that the wire is cut. If any tool has an unsatisfactory cutting performance, or shows signs of indentation of the cutting edges, it is rejected.

MACHINING CHISEL-HANDLES

Turned wooden handles, for the firm's range of wood-chisels, are produced from birch-root. Originally, the blanks for the handles were produced by band-sawing, but this practice has been superseded by trepanning. For this purpose, a vertical-spindle machine is employed, and cylin-

Fig. 8. On This Air-operated Rig, Wire-cutters are Checked for Performance and Cutting-edge Hardness, by Cutting Steel Piano-wire

drical blanks, of the required lengths, are cut from blocks of the necessary thickness. The spindle and a clamp are raised and lowered continuously, in unison, by an air-cylinder, and each time they are raised, the block is rapidly moved to a fresh position. This method is not only faster, but more economical as an appreciably greater number of blanks can be machined from a given block.

The handles are finish-turned, in 5 sec. each, on high-speed wood-turning lathes of the type shown in Fig. 9. These machines are of a standard design, and were fitted with air-hydraulic automatic power-feed equipment, by the company. The work is run at 3,000 r.p.m., and is machined by copy-turning from a template. After they have been machined, the handles are de-burred and semi-polished by dry barrelling. When the quantity is sufficient to load the barrel adequately, the handles are treated without additional ballast. Where ballast is needed, small pieces of waste wood are used to make up the required bulk.

Fig. 9. On This High-speed Wood-turning Lathe, Equipped with Air/Hydraulic Power Feed, Chisel-handles are Copy-turned in 5 sec. each

Equipment for Shaving Titanium Rivets

In the illustration is shown a tool which has been developed by a manufacturing research engineer at the works of the Boeing Airplane Co., U.S.A., for shaving the heads of stainless steel and titanium

Portable Pneumatic Drill with a Tungsten Carbide Rotary File for Shaving Titanium Rivet Heads

rivets. A 1-in. arbor-type tungsten carbide rotary file is mounted on a ¼-in. portable pneumatic drill so that it rotates on two axes. Rivet projection from the skin surface must not exceed 0·002 in. It is controlled by means of an adjustable, threaded housing. The file is driven at 4,180 r.p.m. and it is stated that the dual rotation ensures a high finish on the work.

It has been found that more than 1,000 titanium rivets can be shaved before the rotary file requires to be sharpened.

Stokes Multiple-motion Sequence-controlled Metal Powder Compacting Presses

The F. J. Stokes Corporation, Philadelphia, Pa., U.S.A., have recently developed a range of metal powder compacting presses which incorporate a system whereby the traverse rates and starting positions of the punches can be pre-set, independently of each other. It is claimed that, with such a control system, parts can be compacted with the optimum density, and to close dimensional accuracy. Provision is made for power adjustment of the stops which control the depth of fill, and the lengths of compression strokes for both the upper and lower punches. There are five machines in the range, with capacities varying from 50 to 500 tons, which are suitable for workpieces from 6 to 14 in. diameter, respectively, and Fig. 1 shows the 300-ton, type 713, machine.

Each press has two, coaxial, lower compacting punches which can be arranged to start their upward movements from different levels, and to traverse at different rates, so that they arrive at the full-compression levels simultaneously. The relationship of starting positions and traverse rates of the punches is predetermined, with regard to the shape of the part, the powder employed, and the final density required, and their differential upward movements are then maintained in this required relationship by a potentiometer-controlled, hydraulic, servo-system.

Fig. 1. Stokes Type 713,300-ton Hydraulic Metal Powder Compacting Press, which has Arrangements for Varying the Stroke and Pressure of the Three Lower, and Two Upper, Punches

In addition to these punches, is a third lower punch, which may be used either as an additional compacting member, a movable core-rod, or an ejector, and a rotary switch is provided on the control console for selecting each of these movements. Provisions are incorporated for adjusting the core rod through a distance of ½ in. to compensate for re-facing.

A secondary upper punch is arranged concentrically with the main upper hydraulic ram, and has independent adjustment. During the final compression stroke, both the upper punches abut adjustable mechanical stops, and from this point they are moved, in unison, by the upper ram platen. The mechanical stops for limiting the travel of the upper and lower platens are independently adjustable by power. An air motor is provided for rotating each threaded stop rod, and these motors are controlled, separately, by push-buttons and rotary switches mounted on the control console, a close-up view of which is shown in Fig. 2.

Each of the 2-position rotary switches provides fast- and slow-speed running of the associated motor, and the final positioning of the stop is achieved by an inching-button, one of which is provided for each direction of traverse. The position of each stop, in relation to the upper surface of the die table, is recorded on a 5-digit counter, which is mounted on the control panel adjacent to the push-buttons for setting the relevant stop.

Once the final set-up for a particular workpiece has been determined, the reading of each counter is noted, and recorded for future production runs on the same component. As already mentioned, the machine can be set to operate with a predetermined sequence of punch traverse speeds and pressures, and it is arranged that each separate

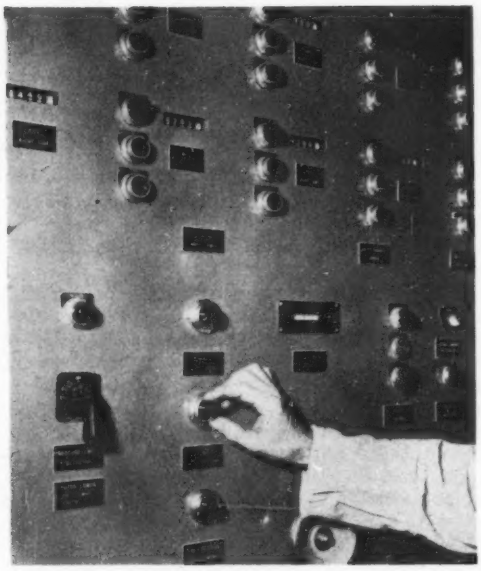


Fig. 2. Close-up View of the Control Console for the Compacting Press seen in Fig. 1. Five-digit Counters are Provided for Recording the Final Positions of the Ram Stops and the Length of Fill Stroke

stage is automatically initiated by the completion of the preceding motion.

The punch platens are guided on four, ground, vertical tie rods, and adjustable, replaceable bushes are fitted for this motion. Bellows-type guards are provided for the tie rods, also for the feed mechanism, rams, and mechanical stops, to afford protection against the entry of abrasive dust. The table has a hardened die-clamp ring, the tapped holes for which are drilled through, so that dust cannot collect. A variable die carrier can be supplied, which allows the die to "float" against an adjustable resistance, and this arrangement is employed to provide an additional compacting motion when a section of a part is to be formed in a stepped portion of the die.

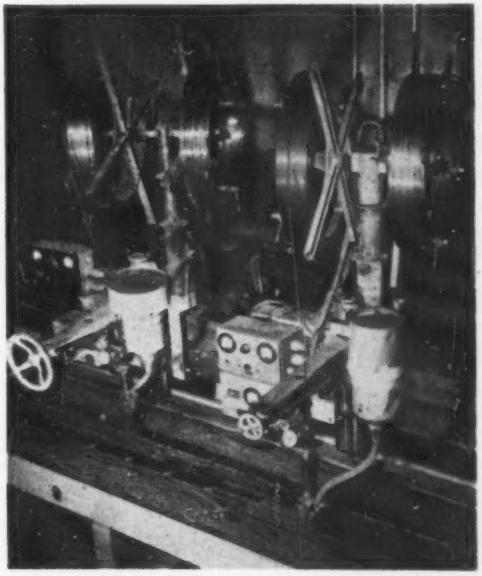
The metal powder container is of the open-top box-type, and provision is made for fitting a smaller box when parts requiring smaller charges are being produced, and both the length and traverse speed of the fill stroke can be adjusted. A selector switch on the control console provides a choice of manual, single-stroke, or continuous operation of the machine. All controls are positioned at a convenient height for the operator.

Welding Equipment for Rapidly Rebuilding Tractor Track Links

The equipment shown in the figure is employed for rapidly rebuilding the links on Caterpillar track. It is stated that a 27-ft. length of track, comprising 39 links, can be completed in 3 hours, whereas with the manual metallic-arc welding method, previously employed, the time was 24 hours.

Each of two Unionmelt DS welding heads is mounted on a separate Linde OM-48 side-beam carriage, and the links are welded on both sides simultaneously. The heads operate independently, and cams, located at the back of each beam, trip a switch whereby the current supply for welding the individual links is controlled.

Two layers of hard-facing are applied with $\frac{3}{16}$-in. diameter wire, and ten passes over each side of the track are necessary to obtain a $\frac{3}{16}$-in. thick deposit. The time for each pass is only 18 min. If the links have worn excessively, they are built up with Oxweld No. 296 wire before the hard facing is applied. Unionmelt No. 80 welding composition is employed. This composition is recommended for building-up operations involving multi-pass welding because it does not increase the silicon and manganese contents of the weld metal.



Two-head Welding Installation for Reclaiming Tractor Track Linked by Hard Facing

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Instrument for Plotting Tooth-form of a Cam-relieved Helical Cutter

On certain workpieces, it is necessary to machine mating forms of semi-circular cross-section. Such forms may be obtained by milling, and to provide an economical life, the cutters employed are usually of the form-relieved type. Normally, the front face of a tooth on such a cutter is at 90 deg. to the side faces. It may be desirable, however, to employ a cutter on which the front faces of the teeth are at some other angle, relative to the side faces, to obtain the improved cutting action associated with conventional helical milling cutters. If cutters of this so-called helical type are form relieved, the cross-section of the corresponding form machined in the workpiece will deviate from that of the cutter, so that, if a true semi-circle is to be obtained, correction must be applied to the tooth-shape of the cutter. The determination of the corrected shape presents considerable difficulties, and an instrument has been developed by Mr. R. G. Vare, 188 Wareham Road, Corfe Mullen, Wimborne, Dorset, whereby the corrected form can readily be plotted.

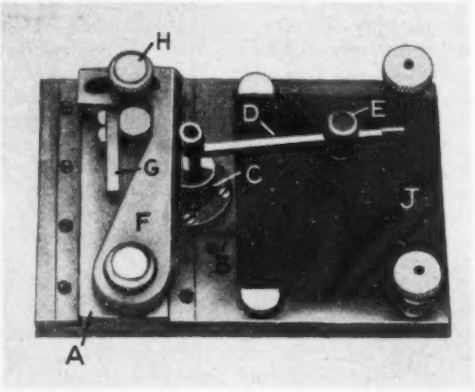
The instrument is shown in the accompanying illustration. A base member incorporates two sets of guideways, one for the slide *A*, and the other for the slide *B*, at 90 deg. to the first. A bearing bracket *C* is mounted on the slide *B* and supports a vertical shaft, to the upper end of which is secured the arm *D*. Precision gear teeth are cut on the vertical shaft, and the arm *D* carries a chuck unit *E*. This unit can be adjusted along the length of the arm, and clamped in any position, and serves to hold a scribing point.

Pressure is applied to the slide *B* by a spring, so that it is urged towards the slide *A*. Pivoted at one end of the latter slide is a sine bar *F*, which has precision rack teeth cut along one edge. The arrangement is such that the pinion shaft on the slide *B* is held in close mesh with the rack on the sine bar. By means of slip gauges, as at *G*, the angular setting of the sine bar can be adjusted, within close limits, and it can be clamped in position on the slide *A* by means of the knob *H*.

At the end of the base remote from the slide *A* there are provisions for locating and clamping a plate *J*, the surface of which is "blued," or has some similar coating. When the various adjustments have been made, the slide *A* is set so that the scribing point in the chuck unit *E*, is positioned towards one side of the plate *J*. The slide is then advanced steadily by hand, and, during this movement, motion is transmitted to the slide *B* by the sine bar, the teeth on the latter member causing the pinion shaft in the bearing housing *C* to rotate. In consequence, the scribing point in the chuck unit *E* traces out a path on the plate *J* which corresponds to the circular motion of the arm combined with the rise imparted to the slide *B* by the sine bar. If the form thus produced is applied to the cross-section of the teeth on a milling cutter of the form-relieved, helical type, it is claimed that a cut of truly semi-circular cross-section is obtained.

The scribed plate can be filed to the line to produce a template from which a form tool can be made for use on the relieving lathe. Alternatively, the template may be used for making tools directly on a copy-type cam-relieving lathe. By fitting a longer arm in place of that indicated at *D*, and mounting the instrument on a drawing board, a layout to an enlarged scale can be made, for checking the form of the tool with the aid of a projector.

It is claimed that the corrected teeth can be ground without introducing significant errors of form. Moreover, it is stated that the instrument can readily be set, and that the calculations involved are simple.



This Instrument has been Developed for Plotting the Corrected Tooth Cross-section of a Form-relieved Helical Milling Cutter

Welding Operations on the Lincoln Uniframe Body

By M. H. TRYGAR* and O. B. SIMMONS*

The 1958 Lincoln cars are being built in one of the newest and most modern car assembly plants in the U.S.A. This plant, covering 1,300,000 sq. ft. and having an output capacity of 112,000 cars per year on a straight-time basis, is located in Wixom (Novi Township), Mich., 28 miles from Detroit.

A feature of these 1958 Lincoln, also Continental, cars is the " uniframe " body construction. With this type of construction, the uniframe comprises the entire underbody, structural members, rear-compartment pan, front engine compartment, and engine supports. Finally, the unitized frame, roof, body sides, front wings, and rear quarter panels are all welded together to form a complete body shell, as seen in Fig. 1.

Increased rigidity and improved safety are important advantages of uniframe construction. In addition, all body panels, with the exception of the bonnet, are painted as an integral unit, with the result that quality is improved. With this design, however, it was necessary to provide special overhead monorail conveyors, body carriers, and similar equipment to handle the heavier bodies and to permit installation of axles, suspension units, shock absorbers, exhaust pipes, and similar components from beneath.

Unitized construction has also increased the welding problems. The 1957 Lincoln body required only 3,300 spot-welds, whereas for the 1958 body the total is 9,850. In addition, heavier-gauge sheets are used in the new car—necessitating welds covering a range from two thicknesses of 0·036-in. sheet up to two thicknesses of 0·090-in. Such welds are made on the same production lines, and, frequently, with the same portable welding guns. In welding the thicker sheets, the capacity of the spot-welding guns is reduced from 200 to approximately 80 spots per min.

All the welding guns are air-operated. With 5-in. diameter cylinders, the guns will provide a welding pressure of 1,570 lb. with an air-line pressure of 80 lb. per sq. in. Where a 5-in.

* Lincoln and Mercury Division, Ford Motor Co., U.S.A.

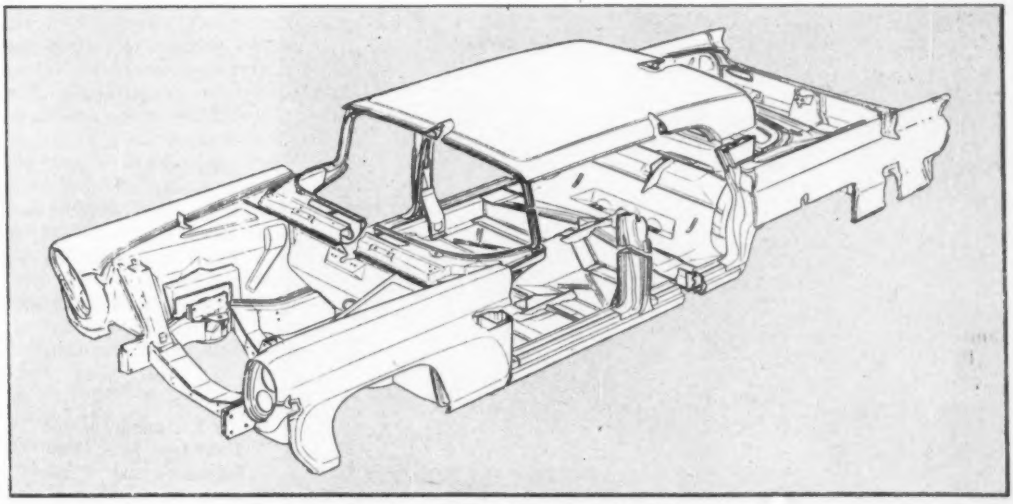


Fig. 1. A Perspective View of the 1958 Lincoln Body, Showing the Unitized Construction of the Frame, Sides, Wings and Panels

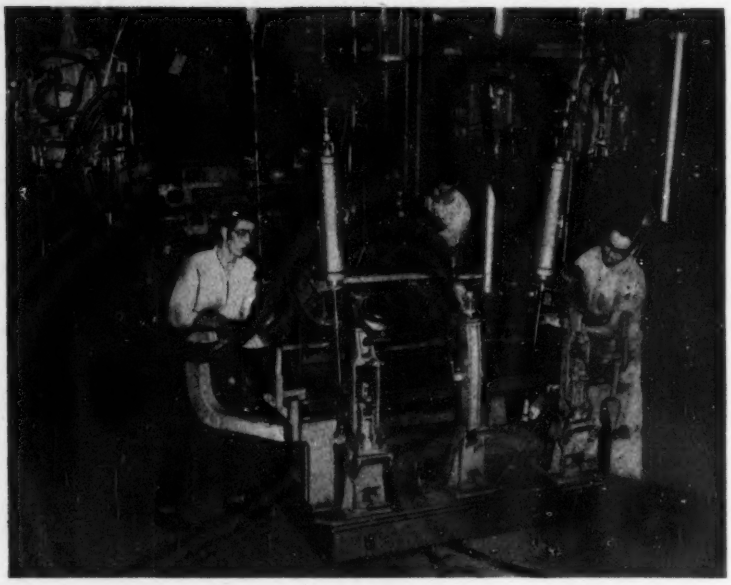


Fig. 2. Roundabout Conveyor Equipped with Fixtures for Joining the Under-body, Floor Pan, and Front End by Means of 1,350 Spot-welds

diameter air cylinder would cause interference with components of the unitized body, tandem air cylinders of 3½-in. diameter are used. The latter arrangement provides ample welding pressure for the heavier-gauge materials. To minimize the risk of shorting or shunting, the welding guns and adapters are insulated with three wrappings of fibre-glass tape. Each layer of tape is retained by the application of a plastics laminating adhesive.

Stampings used in the uniframe bodies are held to close tolerances, since excessive thicknesses of the welding flanges would make it difficult to maintain the high quality of welding specified. Also, to ensure the best results, the combination of welding pressure, time, and temperature is carefully controlled. For each change in metal thickness of approximately 0·015 in., a separate combination of pressure, time, and temperature is employed, controlled by push-button.

Considerable research and experimental work were undertaken to avoid the need for the operator to select the proper pressure, time, and temperature. All that is necessary is to depress the correct button. Each supply air line has its individual regulator, gauge, lubricator, and 4-way valve. Time is controlled by an attachment on the electronic control panel, and the weld current is selected by means of

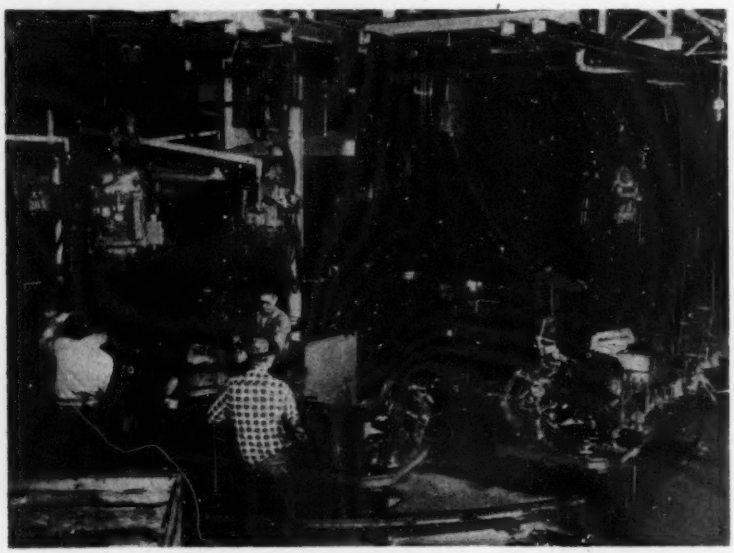


Fig. 3. Both Right- and Left-hand Side Subassemblies are Completed at the Rate of 30 per Hour on a Roundabout Unit

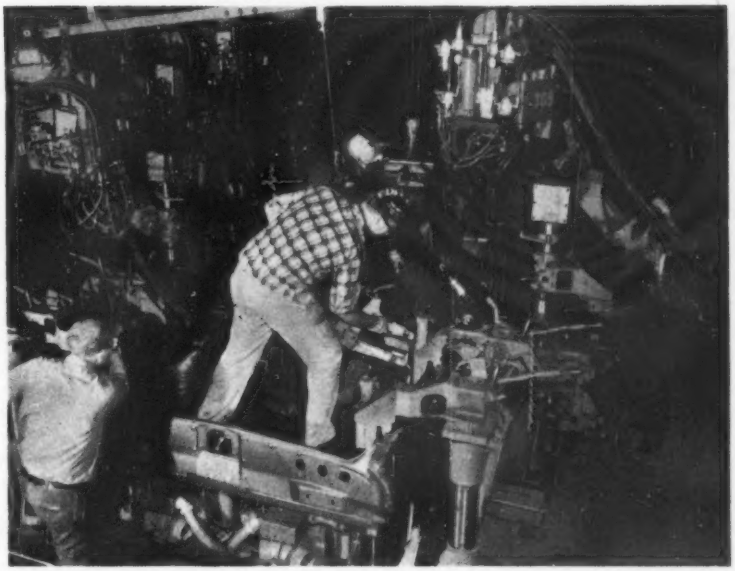


Fig. 4. Six Operators Complete 586 Spot-welds in 10 min. for Joining Together the Under-body, Sides, Wings, and Roof of the Car

phase-shift heat controls, also mounted on the panel.

The soundness and quality of each weld are ensured by the Quality Control Department. It is required that each weld should meet the minimum nugget size specifications of the American Welding Society, as determined by the peel test. Values of pressure, time, and temperature needed for each individual weld are recorded on a card attached to the transformer. These cards also have sketches of the welding electrodes, showing the proper dimensions for tip dressing and the time for tip replacement.

A trace prepared from a weld analyser and recorder is attached to each card. The analyser and recorder has a probe which is placed between the welding-gun electrodes. When the gun is actuated, the pressure, time, and current values are relayed from the probe to a Brush recording unit. The graphical trace thus prepared by the recorder gives a permanent record of the welding set-up. Each day a trace is prepared and compared with a master, and any deviations are corrected to ensure consistent, high-quality welds.

Parts are spot-welded into sub-assemblies on various locating fixtures. A roundabout conveyor, shown in Fig. 2, carries ten under-body assembly fixtures for joining the under-body, floor pan, and front end. A total of 1,350 spot-welds is made on each assembly at this stage.

Completed under-body assemblies are removed from the conveyor and loaded on to a double-chain conveyor leading to the body-truck area. In an adjacent area there is another roundabout conveyor, seen in Fig. 3, which has ten fixtures for assembling the body sides. Each side sub-assembly requires 1,370 spot-welds made by 27 operators. On this roundabout 30 right-hand and 30 left-hand sides can be completed per hour. The side sub-assemblies, after being removed from the conveyor, are attached to the moving under-body assemblies by means of toggle clamps.

Under-body, body sides, front wings, and roof, are lifted off the delivery conveyor as a complete unit and placed in one of the body-framing fixtures, in which all of the major components are joined by spot-welding. The one-stage framing-fixture method of assembly was selected to facilitate maintenance of the close dimensional accuracy and structural requirements laid down by the Product Engineering Department. In front of each body fixture there is a surface plate on which dimensions of the bodies can be checked periodically.

A close-up view of one of the six body-framing fixtures is given in Fig. 4. A total of 586 spot-welds is completed on each body shell in 10 min. by six operators, and an output of 30 unitized bodies per hour is obtained from the six fixtures. The welding of the wheel housing to the floor pan in these fixtures would present difficulty without a special gun mounting. This problem has been solved by mounting the gun on a free-rolling platform and counterbalancing the gun with air. In this way the operator can weld up and around the housing, exerting a force of only about 2½ lb. to raise or lower the gun.

Welded body-shell assemblies are lifted out of the fixtures and placed on body skid carriers. Then they are completed by conventional re-spotting, arc- and gas-welding, soldering, and door-hanging operations. The roof is roller spot-

welded, the spot-welds being spaced at approximately three per in., so that the roof would be practically leakproof even if the water sealer were omitted. The roller spot-welding machine completes nearly 700 spot-welds in less than 1 min.

A feature of the painting arrangement is the immersion of the lower portion of the assembled body unit in about 8 to 10 in. of primer dip in a tank. This treatment ensures that the under-body receives sufficient rust protection. Completely painted and trimmed bodies are carried on an overhead conveyor in special fixtures to facilitate assembly of the remaining components to the under-bodies.

In conventional motor car assembly plants, these operations are carried out on floor-type chassis conveyors, before the bodies are lowered into position. With the suspended assembly system, greater accessibility is afforded, and the operators experience less fatigue because the bodies are always at the most convenient working heights.

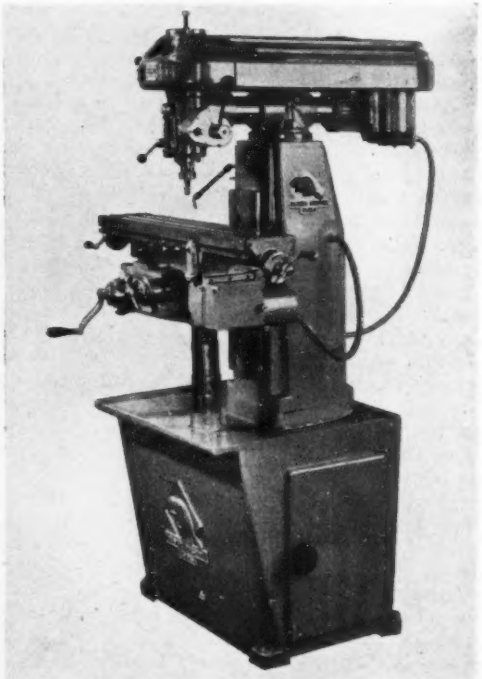
Beaver Type A Vertical Milling Machine

Balding Engineering, Ltd., Bessemer Road, Norwich, have recently placed on the market the Beaver type A vertical milling machine shown.

Drive to the cutter head is taken from a ¾-h.p. motor through V-belts and stepped pulleys, which provide seven spindle speeds ranging from 200 to 3,600 r.p.m. The driving motor and cutter head are mounted at opposite ends of a cylindrical overarm, and can be adjusted horizontally, also tilted through a maximum angle of 180 deg. Maximum and minimum distances of 9¾ and 3½ in. are obtainable between the spindle and the column ways. The motor, cutter head, and overarm assembly can be swivelled through a maximum angle of 180 deg. in the horizontal plane, on a circular guideway at the upper end of the well-ribbed box-section column.

Mounted in adjustable, pre-loaded, taper roller bearings, the spindle is bored to take a No. 30 International taper shank, and a hand axial travel of 3 in. is provided, through a rack and pinion. A maximum distance of 13 in. is obtainable between the spindle nose and the 28- by 6-in. T-slotted work table. A depth stop with micrometer adjustment is fitted for controlling the spindle travel. Reduction gearing with a ratio of 2 to 1 is incorporated in the cutter head, to enable fine feeds to be applied to the spindle, for example, for boring operations. The detachable ball-ended lever for traversing the spindle can be readily mounted on separate shafts extending from the cutter head casting for applying coarse and fine feeds.

The work-table has a longitudinal travel of 15 in., and power feeds ranging from ½ to 4½, or from 1 to 9 in., are available, the drive being taken from a separate ⅓-h.p. totally-enclosed motor, through a worm reduction gearbox and pick-off gears. Reversal of power feed is effected by a conveniently-placed lever, which is moved to the central position, for disengagement of the drive at the end of the working stroke, by means of a stop, adjustably-mounted in a T-slot at the front of the table. The saddle has a cross travel of 7½ in., and the vertical adjustment of the knee is 13 in. The traversing screws for the table and cross-slide each engage with two nuts, which can be readily adjusted for eliminating backlash. Large-diameter friction-type micrometer drums are fitted to facilitate setting the table, cross-slide and knee. The traversing screws for the cross-slide and knee have Acme threads, and end thrust is taken by ball bearings. A coolant pump and suds tank is housed in the well-ribbed cast iron base, which incorporates a cupboard for tool storage.



Beaver Type A Vertical Milling Machine

Danelle Process of Hard Surfacing

Danite Hard Metals, Ltd., Carr Hill, Doncaster, a subsidiary of British Ropes, Ltd., Doncaster, have undertaken much experimental and research work on the process of hard surfacing, and Danelle hard metal has been developed and improved, over a considerable period, to reduce the effects of abrasion, heat and erosion on a wide range of components.

For the many hard surfacing applications where corrosion resistance is not essential, the Danelle process, it is claimed, is economical and efficient, and gives a wear-resisting surface with a life of 10 to 20 times that of hardened steel. The contour of the metal deposited from Danelle hard surfacing rod is flat, so that there is a considerable saving in grinding and finishing times, and special grinding wheels are not required. Ease of application is said to be another feature of the process, a welding outfit and hand grinder being the only equipment necessary, so that existing steel tools and machines can be treated *in situ*.

Danelle can be applied either electrically or with an oxy-acetylene torch to almost any ferrous component. Gas welding is recommended for precision application when finish grinding is necessary, and arc welding for heavy deposits, for example on parts of earthmoving equipment and crusher jaws. By the use of the process, it is often possible to specify a cheaper base metal so that the overall cost of the component is reduced.

Uncoated rods are supplied for the oxy-acetylene method and flux-coated rods for the electrical method. The rods are $\frac{5}{32}$, $\frac{3}{16}$ and $\frac{1}{4}$ in. diameter by 15 in. long, and 1 lb. of rod, of $\frac{5}{32}$ in. diameter, will cover 48 sq. in. of surface to a thickness of $\frac{1}{16}$ in. Hardness figures for the deposited metal are as follows: Rockwell A-82·5 Rockwell C-62/63; and Vickers Diamond Pyramid-800. These values are maintained up to approximately 800 deg. C. owing to the high red-hardness of the deposit.

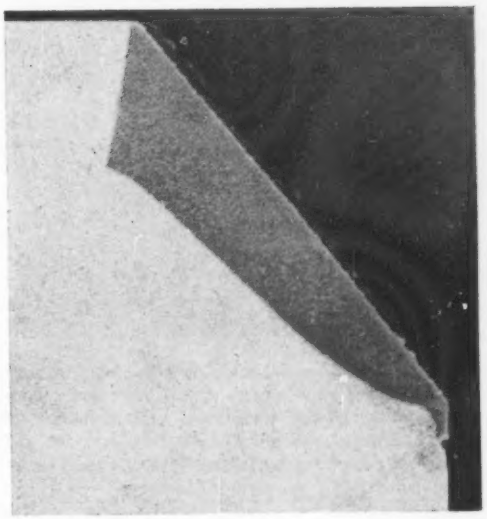


Fig. 2. Photomicrograph (3½×) of Sintered Component with Hard Faced Layer

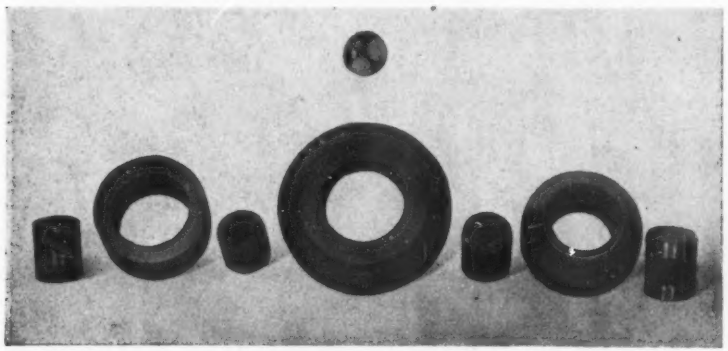


Fig. 1. Sintered Components with Hard Alloy Faces and Inserts

Owing to the deeper penetration into the base metal which takes place with the electric arc method, the deposit may be slightly softer than that obtained by gas welding.

For oxy-acetylene deposition, the surface of the component should be thoroughly cleaned, by grinding, machining or sand-blasting and to minimize distortion, the component should be preheated. With the electric arc method it is

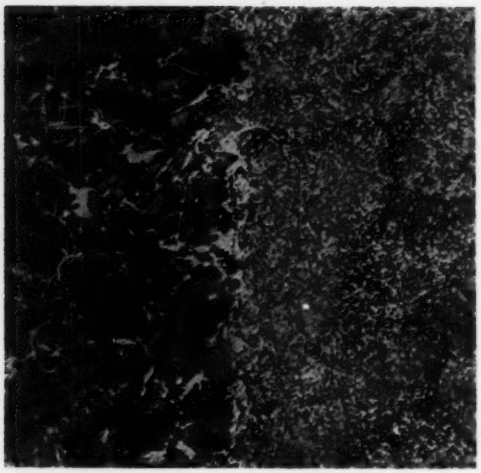


Fig. 3. Photomicrograph (150×) Showing the Structure at the Junction of the Hard-facing and Sintered Steel Zones

not essential to take the same care in cleaning, but all sharp edges and corners should be removed to avoid melting of the steel base, with consequent dilution of the deposited metal.

A recent development in the field of hard facing involves the use of powder metallurgy techniques to produce composite sintered components of reasonably simple forms. The body of such a component is of machinable steel (carbon or stainless) with hard alloy layers at selected portions of the surface to provide wear and abrasive resistance. Some examples of these composite components are shown in Fig. 1. The wear-resisting alloy can be of any reasonable thickness from $\frac{1}{16}$ in. upwards and has a hardness of 56/60 Rockwell C or 600/700 VPN. It is intrinsically hard and its properties cannot be impaired by accidental overheating. While not claimed to be stainless, the alloy is resistant to most alkalies and the organic acids.

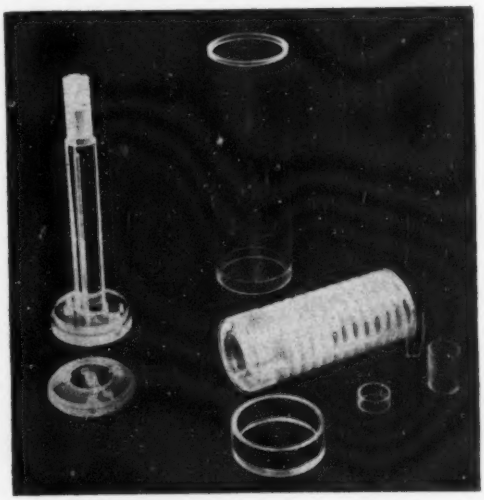
Fig. 2 shows a photomicrograph at 3½× magnification, of a longitudinal section through a composite component with a hard-facing layer sintered in position. Fig. 3 is a photomicrograph at 150× magnification, showing the structure at the junction of the hard-facing and sintered steel zones, of the component in Fig. 2.

Conductimetric Cell Made from Perspex

The accompanying illustration shows I.C.I. Perspex components for a Conductimetric cell which was designed in the Research Laboratories of the General Electric Co., Ltd., and made by R. O. Harris & Co., Ltd., 61 Bayham Place, London, N.W.1, who specialize in the production of machined and fabricated parts in this plastics material.

The cell is employed in connection with the determination of carbon in metals. For this purpose a sample is heated in oxygen so that the carbon content is converted into CO_2. The latter is then dissolved in a solution of caustic soda or barium hydroxide, and the change in conductivity of the solution is measured.

Components of the cell include the tubular body, end plates, a drilled core rod, 6 in. long, a gas plate with 0·006-in. diameter holes, and a piece with an external helical groove which forms a path for the gas bubbles. The latter part was machined from the solid by turning, boring, drilling, and tapping, and the helical groove was machined at one cutting traverse.



Machined Perspex Components for a Conductimetric Cell for the Determination of Carbon in Metals

Federal Automatic Machine for Bracket Manufacture

An interesting automatic machine, which was recently supplied to the Dodge Division of the Chrysler Corporation, U.S.A., by the Federal Machine & Welder Co., Warren, Ohio, has been designed to carry out spot-facing, reaming, deburring, and welding operations on motor vehicle brake pedal brackets. A general view of the machine, from the loading end, is given in Fig. 1, and there is an endless conveyor system, comprising two chains to which holding fixtures for the brackets are connected at intervals. The chain conveyor is indexed, through a distance of approximately 12 in., to carry the holding fixtures to the various machining and welding stations along the track, by a Geneva mechanism. The wheel of this Geneva mechanism is driven, through a speed-reducing unit and a variable-pitch pulley, from a totally-enclosed fan-cooled motor, equipped with an electrical clutch-brake mechanism.

The fixtures on the conveyor are supported on a sturdy weld-fabricated steel frame, which forms the bed of the machine and provides attachment surfaces for brackets carrying the various machining heads and welding units. It may be noted that several of the tools and hopper feeding units are missing in the illustration, since they were fitted to the machine after it was delivered and installed in the factory. A view showing a bracket pressing and the parts which are to be welded to it, also a completed bracket, is given in Fig. 2. The bracket is of 0·075-in. thick sheet steel, and a reinforcing plate of ⅜-in. thick steel is secured to each side, by means of four projection welds. The plates are supplied with projections at the corners for this purpose. In addition, six special bolts, of ¾ in. diameter, are projection welded to the pressing. Each bolt head is formed with three radial welding projections, of approximately square section, on the thread side.

The brackets are loaded manually by an operator standing at the left-hand end of the machine in Fig. 1, and the reinforcing plates are also hand-loaded, in batches, into inclined magazines at each side of this position. A close-up view of the loading station is given in Fig. 3, where these magazines are indicated at A. At the lower end of each magazine there is an air-operated escapement, actuated by a solenoid valve during each machine cycle, which allows one plate to descend into a holder on the end of a water-cooled welding head, while it is in the retracted position, as shown. In the holder, the plate is held in the correct position for attachment to the bracket wall when the head is advanced by the large air cylinder at the outer end of the welding head. The fixtures may be seen more clearly in Fig. 5, which shows a later stage of the machine.

In each fixture, the bracket is loaded with the flanges, to which the bolts are to be welded, facing

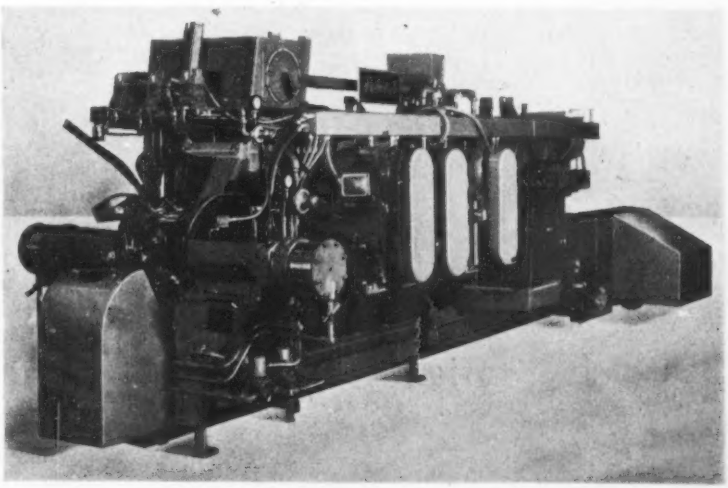


Fig. 1. General View, from the Loading End, of the Special Automatic Federal Machine for Welding and Machining Operations on Motor Car Brake Pedal Brackets

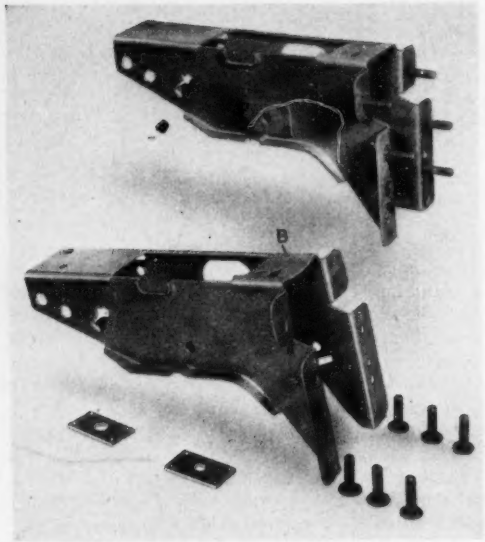


Fig. 2. A Pedal Bracket, and the Reinforcing Plates and Special Bolts to be Welded to it, are Here Seen, Together with a Bracket on which the Welding Operations have been Completed

downwards, and with the face *B*, Fig. 2, vertical and towards the operator. In this position, the bolt flanges rest on copper back-up blocks, let into the top surface of the fixture, and the bracket is supported by a forked projection *C*, Fig. 5, of built-up construction, into which the lower end of the wall *B*, Fig. 2, is inserted. Including the loading station, there are 15 stations on the top surface of the machine bed, to which the fixtures are successively indexed. On leaving the loading position, the fixture moves directly to the station at which the two reinforcing plates are to be projection-welded in place. At this and other stations along the track, except the idle positions, the bracket in the fixture is engaged by an overhead clamp, which serves to hold the component in place and to steady the fixture.

The air cylinder whereby each clamp is operated is fitted in a slightly inclined position, so that the clamp may enter the pressing more easily, and the cylinder for the second station is indicated at *D*, Fig. 3. The inclination also allows the ram of the cylinder, and the slide which it operates, to clear another cylinder, mounted in front of the slide, at *E*. Attached to the ram of the cylinder *E* is a copper back-up block, which enters the space between the walls of the pressing when the cylinder is operated, and prevents them from being distorted by the pressure exerted by the welding heads. After the overhead clamp and the back-up blocks have been brought into position, the air cylinders of the welding heads are energized so that the reinforcing plates in the heads are pressed against the outer walls of the bracket. A pressure of 40 lb. per sq. in. is employed, and when the plates are in contact with the bracket, the welding current, which is supplied by a 150-kVA., Federal stacked-iron transformer, flows from plate to plate in series, for a period of 18 cycles.

Pressure is then maintained for a further period of 20 cycles, to allow the welds to cool, after which the welding heads are retracted, and the operator presses two buttons to index the fixture to the next position. This position, seen in the centre of Fig. 4, which is a view from the opposite side of the plate-welding station, is idle,

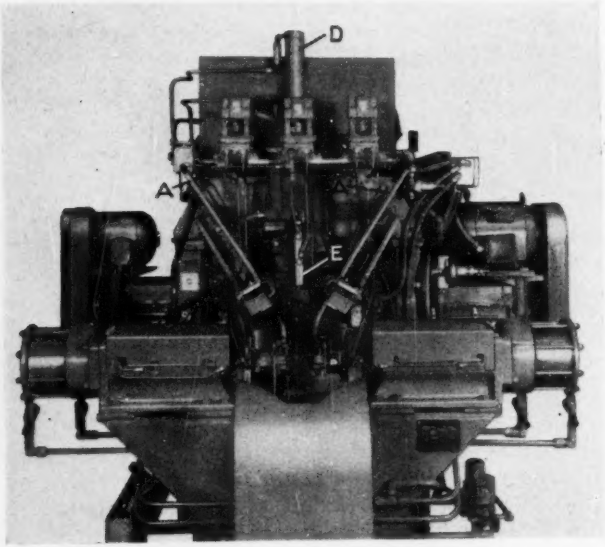


Fig. 3. Close-up View of the Loading Station on the Federal Machine Showing the Air-operated Magazines *A*, Whereby the Reinforcing Plates are Fed to the Holders on the Welding Heads Beneath

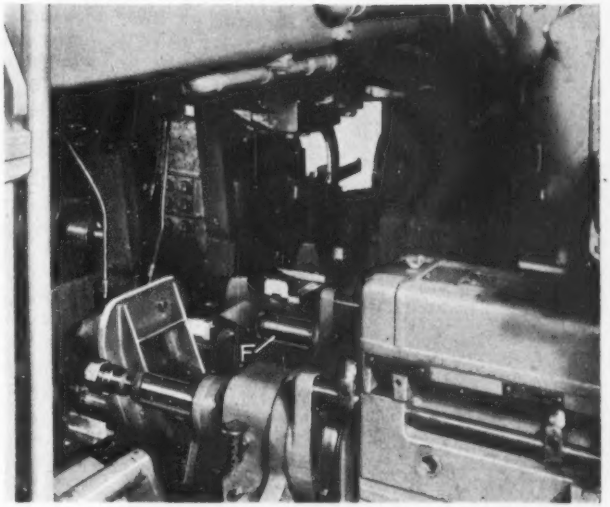


Fig. 4. In this View, the Welding Heads Adjacent to the Loading Station in Fig. 3 may be seen in the Background, and some of the Drillunit Drill Heads for Spot-facing, Reaming and De-burring Operations, in the Foreground

and when the machine is next indexed, the fixture is carried to the fourth station, at which there is a Drillunit drilling head mounted at one side. At each of the four machining stations there is another inclined overhead clamp, which is brought down by an air cylinder to hold the bracket securely in the fixture and support the side walls against the machining pressure. After this clamp has been applied, the bracket flanges are separately clamped by a hinged plate at each side. These side clamps also have pins which enter certain of the flange holes, to ensure that the bracket is accurately located for the machining operations, and they operate micro-switches to complete the circuits for the operation of the unit drill heads.

The unit head on the right-hand side of the machine—facing the loading end—at station 4 is equipped with a tool for spot-facing the area round the hole in the reinforcing plate on that side, to a diameter of 1·18 in. All the heads employed for the spot-facing and reaming operations are arranged to operate on a cycle which provides for fast approach, slow feed for machining, and fast return to the retracted position. The spindle driving motors run continuously. Of the two drill heads at station 5, that on the right-hand side of the machine is equipped with a ½-in., and that on the left-hand side with a ⅝-in. diameter reamer, the spindle for the latter being indicated at *F* in Fig. 4. These reamers operate on the punched holes in the reinforcing plates and the bracket, to finish them accurately in line. Similar heads are provided on alternate sides at the next two stations, and their spindles are equipped with Cogsdill Burraway de-burring tools which operate on the reamed holes. The heads are first advanced rapidly to pass these tools through the holes and are then retracted slowly for the de-burring operations, which are performed on the inside surfaces of the brackets.

The next two stations are idle, and at station 10

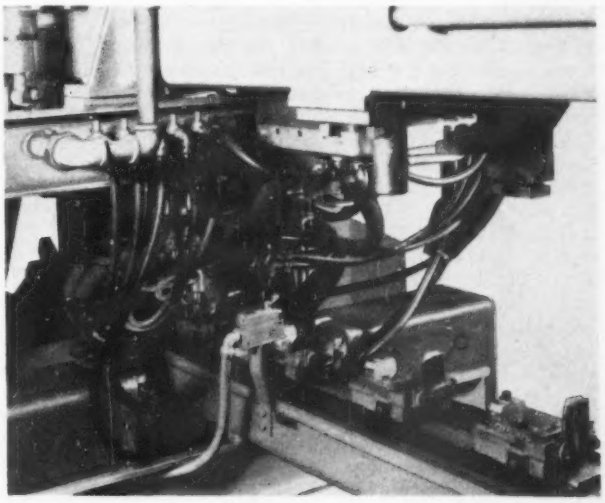


Fig. 5. After the Machining Operations have been Completed, the Brackets are Carried by the Fixtures to a Station to the Right of that at *C*, where the Bolts are Inserted in the Flange Holes, and Thence to the Welding Station Beyond

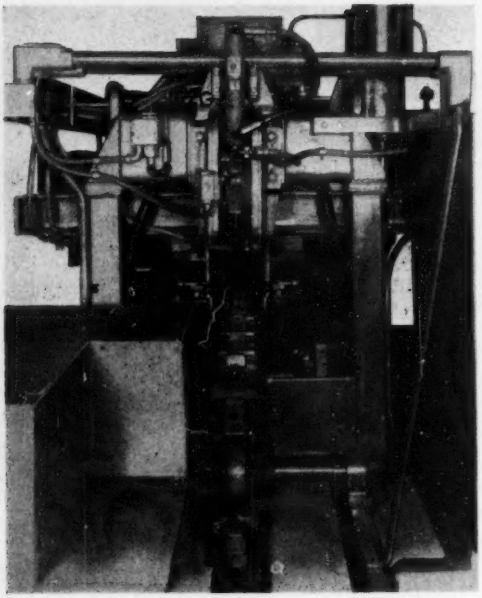


Fig. 6. A View of the Unloading Station of the Automatic Machine. The Ram of the Air Cylinder *G* is Connected to a Gripping Mechanism whereby the Completed Bracket is Lifted Out of the Fixture and Thrown into a Container

there will be two automatic feed units equipped with vibratory hoppers for the bolts, which are inserted in the flange holes by feed fingers. Bolts are fed automatically into the fingers, and as the fixture is indexed into position, the fingers move inwards, carrying the bolts into position above the flange holes. Punches are then operated to push the bolts downwards, out of the fingers, into the holes in the bracket flanges, as seen in the upper view in Fig. 2. The punches are then raised, and the feed fingers are retracted, so that the fixture can be indexed to the next position, which is indicated at *C* in Fig. 5, and is idle. The next station, also, is idle and the fixtures then arrive at station 13, at which the welding operation is carried out. There are three welding electrodes on each side, which are cranked so that they can be applied to the bolt heads, and are mounted on slides so that they can be advanced into the welding position, and retracted to allow the fixtures to be indexed. Each electrode is moved vertically by a separate double-acting hydraulic cylinder, supplied from an air-powered intensifier.

The electrodes are wired in pairs to three separate, 75-kVA., package-type transformers, so that series welds are made from one bolt of a pair to the other. Welding current flows for a period of 15 cycles, and the pressure is maintained for a further period of 20 cycles, while the welds cool, after which the electrodes are raised and retracted. At the next indexing movement of the fixture, the bracket is carried to the idle station 14, and then to station 15, where it is unloaded. A view of this unloading station is given in Fig. 6. It is equipped with a swivel-mounted air cylinder *G*, the ram of which is connected to a gripping mechanism. This gripping mechanism is moved downwards to engage and grip the bracket, and then raised by the cylinder. As it rises, the gripping unit is moved outwards, by the inclined tracks in which it is guided. At the same time, the grip is released so that the bracket is thrown outwards, away from the machine, into a container. The empty fixture then moves downwards, over the end pulley of the conveyor, and returns to the loading end of the machine. When operating at 80 per cent efficiency, the machine gives an output of 620 completed brackets per hour.

Shearcut Gizmo Hole Finishing Tool

Recently introduced by the Shearcut Tool Co., 7045 Darby Avenue, Reseda, California, U.S.A., the hole finishing tool shown in the figure is known as the Gizmo, and is the subject of a patent application.

Intended for use on drilling machines, centre and turret lathes and automatics, for example, the

Shearcut Gizmo Hole Finishing Tool

tool is fed through a previously reamed or drilled hole in the work, and, at the same time the tool or the workpiece is rotated. Due to the resulting burnishing and compression of the workpiece metal, it is stated, the hole is formed to a high degree of accuracy for diameter, straightness and surface finish. The tool is claimed to be particularly suitable for use on non-ferrous metals, and is available in diameters from $\frac{1}{8}$ to 1 in.

The Sixth Mechanical Handling Exhibition—1

The Sixth Mechanical Handling Exhibition will be opened at Earl's Court, London, on May 7, by The Rt. Hon. Viscount Chandos, P.C., D.S.O., M.C., and will continue until May 17. In accordance with the increasing attention that is now rightly being paid to all aspects of the movement of materials and goods, this biennial exhibition is achieving progressively greater size and importance, and on this occasion it will occupy both the ground and first floors of the building and will cover an area of 500,000 sq. ft. There will be about 300 stands, and in addition to products of the leading British firms in this field, there will be exhibits from France, Germany, Italy, Scandinavia, and the U.S.A. All types of mechanical handling equipment will be on view, and conveyors, cranes, hoists, industrial trucks, fork-lift trucks, and stackers will be particularly well represented, also pneumatic and hydraulic units, control gear, and prime movers.

A convention will again be held in connection with the exhibition, at which leading authorities will present papers concerned with the latest handling methods in particular industries.

Some exhibits which are likely to be of particular interest to readers of MACHINERY have been selected for description in the following pages, and others will be considered in subsequent issues.

Felco Hoists, Ltd., 29 Cromwell Road, London, S.W.7. Stand No. 118, Ground Floor

An entirely new range of low-lift hydraulic jacks, one of which is illustrated in Fig. 1, will be shown by this company.

Of light weight and compact design, these hand-operated jacks are available in capacities of 10, 20 and 30 tons, and the smallest and largest sizes have piston travels of 1⅞ and 2½ in. The 20-ton jack can be supplied with piston strokes of 1¾ or 3⅜ in. With the pistons in the raised position, the jacks have overall heights of 4⅝, 5¼, 8½ and 7⅞ in., but these dimensions can be increased by the use of spacer discs which are available with thicknesses of $\frac{13}{32}$, $\frac{1}{32}$ and 1 in. A special stand, which incorporates a handle and has provision for storing the spacer discs, is provided to facilitate carrying the jack.

Another new product to be shown is the Templewood spring-balanced crane fork, which is intended to be suspended from the lifting hook of a crane to facilitate handling crates and stillages, for example, particularly in narrow gangways. This attachment comprises a pair of C-shaped forks, which may be of fabricated steel construction or machined from steel forgings, and are available in various sizes to accommodate loads ranging from 24 to 54 in. wide and from 18 to 78 in. high, with a maximum weight of 5 tons. The attachment can be supplied with the outsides of the forks spaced at distances ranging from 16 to 72 in., to suit the length of load which is to be handled.

Due to the spring balancing arrangement, the forks are tilted slightly downwards when they are unladen to facilitate picking up and discharging loads, and the need for accurately "inching" the crane hook is avoided. When a load is being carried, the forks are tilted upwards by the action of the springs, so that there is no risk of the load slipping.

Other items to be shown will include hand-operated triple-gear chain blocks, travelling trolleys, ratchet hoists, Adjust-A-Leg equalizer slings, and pillar-type jib cranes.

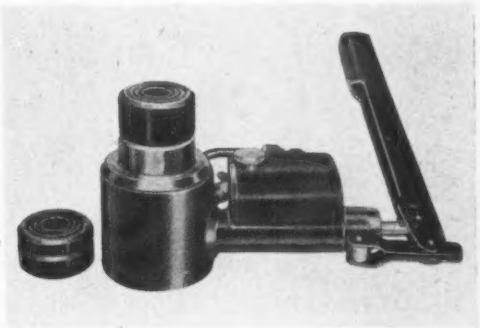


Fig. 1. Felco Low-lift Hydraulic Jack

Matling, Ltd., Park Lane, Fallings Park, Wolverhampton. Stand No. 115, Ground Floor

A selection from their range of battery-operated fork-lift trucks, straddle fork trucks, stackers, stillage and pallet transporters, and platform trucks will be shown by this company.

Attention may be drawn to a pedestrian-controlled truck of the elevating platform type which they have developed in conjunction with Talbot-Ponsonby & Co., Ltd., for handling large press tools weighing up to 3 tons. When a tool is to be removed from a press, for example, the 34- by 32-in. platform, which is raised and lowered hydraulically, is brought level with the bed. A chain is then passed round the tool and its ends are attached to an angle-section cross rail fitted with hook-shaped members which engage with a pair of roller chains incorporated in the platform. Rotation of a crank, which is connected to the driving sprockets for the roller chains by reduction gearing, then serves to pull the tool from the press on to the platform. When the crank is rotated in the opposite direction, the tool is pushed from the platform by means of the cross rail.

Lang Pneumatic, Ltd., Birmingham Road, Wolverhampton. Stand No. 282, First Floor

This company will be showing examples from a recently-introduced Pneulang range of "basic" air cylinders which are made with bores of 1½, 2½ and 3 in., and eleven different strokes from ½ to 12 in. Interchangeable brackets, of various designs, are available for use with these cylinders, and enable eight different mounting arrangements to be obtained. One of the new cylinders, and the different types of mounting brackets, are shown in Fig. 2.

Made from solid drawn brass tubing, the cylinder is fitted with a large-diameter stainless steel piston rod which is lubricated by molybdenum disulphide grease packed in a cavity in one of the end pieces. The latter, which are machined from brass stampings, are secured to the cylinder by pre-stressed mild steel tie rods, fitted with self-locking nuts. The piston is also made from brass stampings and is provided with oil-resistant synthetic rubber seals at the periphery, and an O-ring at the bore to prevent leakage of compressed air along the piston rod.

Conveyancer Fork Trucks, Ltd., Liverpool Road, Warrington. Stand No. 90, Ground Floor

Several recent additions to the company's range of fork-lift trucks will be displayed, including a type TC-6 series 4 with a capacity of 6,000 lb. at 20-in. load centres, which is available with a diesel or petrol engine and has a torque converter drive. Another new product to be shown is the 2-ton fork-lift truck illustrated in Fig. 3, which also has a torque converter drive, and is intended primarily for outdoor operation.

A type E2-20 electric fork-lift truck will be shown fitted with forks of new design which permit crates to be handled without the need for pallets. A side shift arrangement is incorporated to facilitate accurately positioning the forks so that they can be passed through openings in the ends of the crates. Another new item is a reach-type fork-lift truck which is designed for use in narrow gangways. The mast and forks assembly is arranged for power traverse on channel-shaped chassis members, and is brought to the forward position for picking up and discharging the load. When the mast is moved to the rearward position the load is supported within the wheelbase. This truck is available in capacities of 2,000 and 3,000 lb., and may be fitted with tilting forks of new design.

The Skid-Stac attachment, which will be demonstrated on a type E4-20, 4,000 lb. capacity, electric fork-lift truck, enables cartons

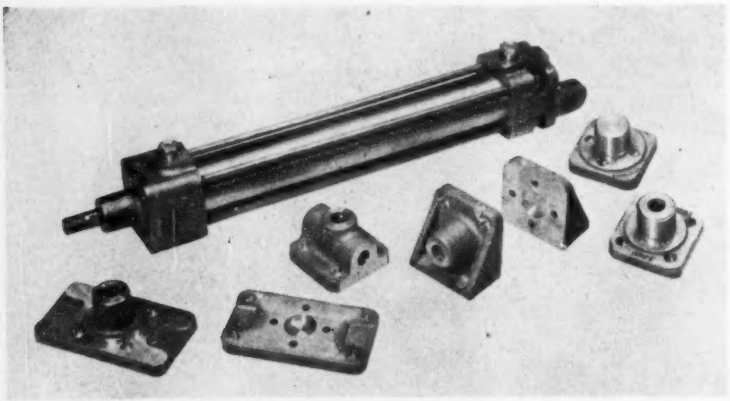


Fig. 2. One of the New Lang Pneumatic "Basic" Air Cylinders and Examples of the Interchangeable Mounting Brackets

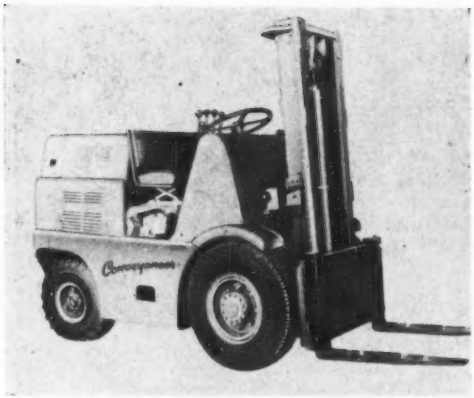


Fig. 3. The New Conveyancer 2-ton Fork Lift Truck

and bags mounted on a sheet of fibre board to be handled for stacking, so that pallets are not required. A recently-introduced type FE-4 flame-proof electric fork-lift truck will be shown fitted with forks of new design, which enable one, two or four drums to be handled either with or without the use of pallets. Another exhibit will be a new 3-wheel electric fork-lift truck, which will raise 2,000 lb. at 24-in. load centres, and is said to be particularly manoeuvrable.

Opperman Gears, Ltd., Newbury, Berks. Stand No. 270, First Floor

The exhibits of this company will include geared motor units for horizontal foot mounting in sizes from f.h.p. to 60 h.p., vertical flange-mounted geared motors, up to 25 h.p., with single reduction worm gearing, and co-axial speed reducers of the spur and helical gear types, with capacities up to 60 h.p. Single reduction worm gear speed reducers up to 120 h.p., and double reduction worm gear speed reducers for output torques up to 100,000 lb.-in., will also be on view. The display will include examples of gears which are made by the company to suit customers' requirements.

John Holroyd & Co., Ltd., Milnrow, Lancs. Stand No. 337, First Floor

On this stand will be shown a selection from the company's H range of worm reduction units of the under-driven, over-driven, vertical, and double reduction types, also f.h.p. worm reduction gear-boxes and lift gear units.

Examples of worm, spur, and single- and double-helical gears, also screws and nuts, made by the company, will be displayed. Among other exhibits may be mentioned wormwheel blanks in Super Holfos centrifugally cast phosphor bronze, tubes in Holfos Spuncast phosphor bronze, silicon bronze and leaded bronze, and a selection of machined components. Castings made in shell moulds from Holfos bronze and other copper alloys, such as aluminium bronze and leaded gunmetal, will be shown together with forged parts and blanks in carbon and alloy steels.

Newman Industries, Ltd., Yate, Bristol. Stand No. 278, First Floor

In Fig. 4 is shown an example from a new range of f.h.p. electric motors which is being exhibited by this company.

Intended for use with machine tools, flexible shaft equipment, pumps, office machines, and domestic appliances, for example, these motors are at present being made in sizes of ⅛, ⅙ and ¼ h.p., and have an operating speed of 1,500 r.p.m. They are available with drip-proof enclosures as type DS split-phase with normal starting torque; type DK capacitor-start for high torque duty; and type DC 3-phase machines. Suitable for operating in a variety of positions, the motors can be supplied with bases of different types for solid or resilient mounting, and built-in overload protection devices, arranged for hand or automatic re-setting, can be provided.

The frame is made from steel plate, rolled to form a cylinder and then seam welded, and white-metal lined, steel-backed, sleeve-type bearings are

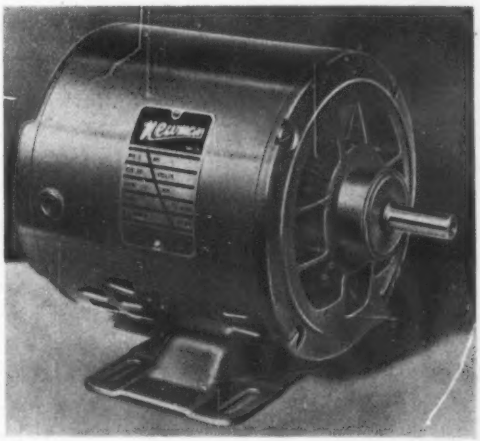


Fig. 4. An Example from the New Newman Range of Fractional Horse-power Motors

housed in the cast iron end shields. A fan is die cast integral with the rotor, and the moving part of the centrifugal switch is built up from steel pressings.

Other exhibits will include the recently-introduced Thoroughbred single-phase motor, totally enclosed machines with double air circuit, vertical pump motors with solid and hollow shafts, and explosion- and flame-proof motors.

Lansing Bagnall, Ltd., Kingsclere Road, Basingstoke, Hants. Stand No. 44, Ground Floor

The type FSHP1 hand-propelled stacker-truck; which will be exhibited by this company, will handle loads weighing up to 10 cwt., and can be used in gangways less than 6 ft. wide. As was mentioned in MACHINERY, 92/797—4/5/58, hydraulic power for raising the forks is provided by a piston-type high-pressure pump, driven by a battery-operated motor. A lifting speed of approximately 10 ft. per min. is provided, and movement of the forks is controlled by push buttons. The truck is available with straddle widths up to 42 in. and lift heights up to 84 in.

Another exhibit will be the type FSES high-lift stacker truck, which has a capacity for loads up to 3,000 lb., and may also be used in gangways less than 6 ft. wide. Available in capacities of 4,000 and 6,500 lb., the type POES "ride-on" pallet truck (MACHINERY, 89/1085—9/11/56), to be displayed, is particularly intended for carrying loads for fairly long distances, and the high degree of manœuvrability provided enables it to be used in confined spaces such as gangways in machine shops. A second pallet truck, designated PP230, which will be on view, is claimed to be the smallest of its type, and can be supplied for handling loads up to 3,000 and 4,500 lb.

Reference may also be made to the type FRES reach truck, the mast and forks assembly of which is power-traversed on channel-shaped chassis members for picking up and discharging loads when stacking is being carried out. The display will also include the recently-introduced type TOER battery-operated tractor shown in Fig. 5.

Fig. 5. Lansing Bagnall Type TOER Electric Tractor

Varatio Strateline Gears, Ltd., 277-279 Aberdeen Avenue, Trading Estate, Slough, Bucks. Stand No. 247, First Floor

The Varatio variable-speed gear boxes, with conical gear clusters, which will be shown by this company, are available with ratings from 1½ to 45 h.p., and provide 7, 9 and 13 speeds with overall ratios of 2, 3 and 4 to 1. They have co-axial driving and driven shafts, and a feature of the design is that speed changes can be made without slip under full load.

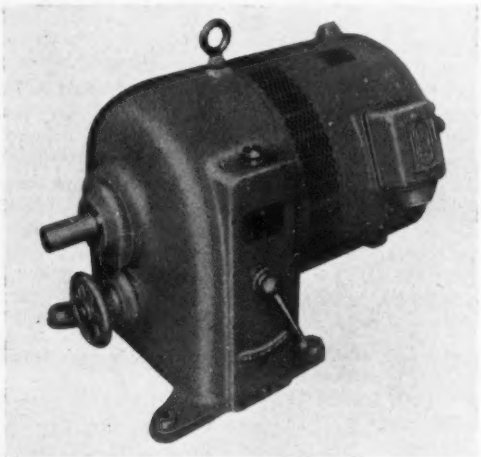


Fig. 6. One of the New Varatio Variable-speed Gear Boxes

Recent developments to be exhibited include 2- and 3-speed gear boxes with ratings of 5, 15, and 35 h.p., which incorporate spur gearing and can can be supplied with and without driving motors. In Fig. 6 is shown the largest gear box in the new range, which is equipped with a flange-mounted motor with an operating speed of 1,000 r.p.m., and gives a speed ratio of 4 to 1. Higher

speed ratios can readily be provided, if required.

The display will also include examples from the firm's range of Strateline hypocycloidal speed reduction gear boxes, which are made in 1-, 2- and 3-stage designs, and provide speed ratios ranging from 3:1 to 1,000,000:1. Recent additions to this range, which will be on view, include units arranged for universal flange mounting, and gear boxes with output shafts set at right angles.

Electropower Gears, Ltd., Kingsbury Road, London, N.W.9. Stand No. 241, First Floor

Exhibits on this stand will include examples from the Swedish-made range of Brottby variable-speed geared motor units, for which the company

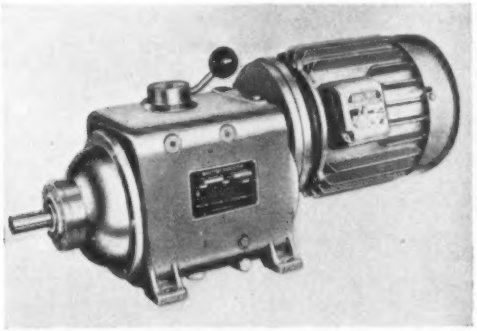


Fig. 7. An Example from the Brottby Range of Variable-speed Geared Motor Units

have recently been appointed distributors in this country.

Available in sizes from ¼ to 25 h.p., for foot and flange mounting, these units incorporate rollers and races of steel, hardened and ground, which run in oil baths and provide for the transmission of constant horse-power over the full speed range. One of the units, arranged for foot mounting, is shown in Fig. 7. Speed variations are obtained by means of a knob on the gearbox which is set with reference to a circular scale. If required, the speed adjusting mechanism can be remotely controlled by a servo motor or by a lever through a system of ball-jointed shafts.

Recent additions to the company's range of products which will be shown will include worm-geared motors up to 2½ h.p.; gearboxes with separate re-circulating oil systems, for operation at speeds up to 35,000 r.p.m.; electronically-controlled variable-speed motors; mechanically-operated reversing and variable-speed gearboxes; and the speed reduction units with contra-rotating shafts, which were described in MACHINERY, 90/1103—17/5/57.

Renold Chains, Ltd., Renold House, Wythenshawe, Manchester. Stand No. 201, First Floor

Various types of conveyor chains with solid and hollow bearing pins, and fitted with attachments for different conveying and elevating duties, will be shown by this company, together with a selection from their range of precision roller chains for power transmission.

The Coventry Mark 5 steel roller chains, which will be on view, are suitable for both conveying and power transmission duties. Power transmission accessories to be displayed will include chain wheels and pinions and chain and flexible couplings. In addition, there will be examples from the range of sprag clutches, which the company have recently started to make. Full details of these clutches were published in MACHINERY, 92/382—14/2/58.

Keelavite Rotary Pumps & Motors, Ltd., Allesley, Coventry. Stand No. 319, First Floor

This company's GP range of hydraulic gear pumps, which hitherto comprised units with delivery rates from 4 to 9 gal. per min. at an operating speed of 1,000 r.p.m., has recently been extended, and examples of the new sizes will be shown. Some applications of these pumps will be indicated by working exhibits.

The new pumps, one of which is illustrated in Fig. 8, have delivery rates from 16½ gal. per min. at a speed of 1,000 r.p.m., and can be operated at speeds up to 3,000 r.p.m. Maximum fluid pressures from 2,000 lb. per sq. in. for the smaller pumps, down to 1,000 lb. per sq. in. for the largest size, are obtainable. Driving shafts may extend from the front or rear, or from both ends of the body, and pumps can be supplied for clockwise or anti-clockwise rotation.

Examples of the company's type G hydraulic gear pumps will be displayed, together with a selection

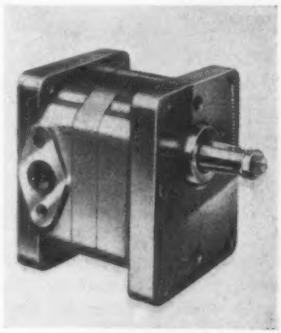


Fig. 8. One of the New Keelavite Type GP Hydraulic Gear Pumps

from the extensive range of hydraulic control equipment, including a new ½-in. directional valve. In addition, there will be various sizes of Keelavite hydraulic cylinders.

Vaughan Crane Co., Ltd., West Gorton, Manchester, 12. Stand No. 96, Ground Floor.

A recent development to be displayed by this company is a Vestac Series 2 overhead crane crab, which incorporates magnetic slip couplings for

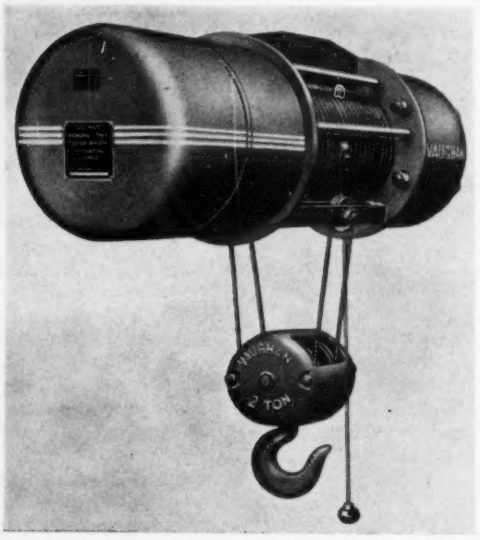


Fig. 9. Vaughan Type E.B.58 2-ton Electric Hoist

transmitting the drive for the hoisting, traversing, and travelling motions. With this arrangement, the driving motors are run continously at constant speed, and reversal and speed variations are obtained entirely by the couplings. Since only low power is needed for the excitation of the couplings, the control equipment is of very small proportions, and the use of heavy-duty resistances has been avoided.

The control equipment for the hoisting motion incorporates a Metropolitan-Vickers flux re-setting magnetic amplifier, and a D.C. solenoid-operated brake is fitted. Three hoisting speeds are obtainable, which are automatically maintained at constant value irrespective of the load being handled. Metropolitan-Vickers Perigrip brake units are provided for the traversing and travelling movements.

In Fig. 9 is shown a type E.B. 58 2-ton electric hoist—one of a new range with capacities from ½ to 3 tons—which will be exhibited. These hoists incorporate the company's patent twist-grip control system, and limit-switches are fitted for preventing over-travel of the hook in either direction. Various types of hand-operated and motor-driven trolleys are available.

Carter Gears, Ltd., Thornbury Road, Bradford, 3. Stand No. 356, First Floor

Examples of Carter type A and type F hydraulic variable speed gears, with handwheel, lever, hydraulic relay, and electric remote control arrangements, will be demonstrated on this company's stand, as representative of a range which covers capacities from fractional up to 35 h.p. The exhibits will indicate some of the many ways in which the firm's gear units can be employed in conjunction with driving motors and speed reduction gearboxes to provide variable speed drives for a diversity of applications.

A new sectioned working model of a type A gear will be on view, also a type F unit with a body made entirely from transparent plastics.

Dowty Group, Ltd., Cheltenham. Stand No. 256, First Floor

A reversible variable-speed hydraulic drive, which will be shown in operation on this stand, has been built up entirely from the company's standard range of pumps, motors and control equipment.

A full range of the firm's hydraulic gear pumps, which give delivery rates from 0·6 to 50 gal. per min., and motors in sizes up to 30 h.p., will be displayed. These items will include a tandem pump unit. A new product, which will be shown, is the hand-operated hydraulic pump illustrated in Fig. 10. This pump provides a maximum pressure of 2,500 lb. per sq. in. and will deliver 0·82 cu. in. of fluid at

Fig. 10. Dowty Hand-operated Hydraulic Pump

each double stroke of the operating lever. A built-in reservoir has a capacity for 6 pints of hydraulic fluid.

The Dowty range of hydraulic control equipment will be represented by various sizes of single and multiple valve assemblies, which are suitable for operation at working pressures up to 2,500 lb. per sq. in. and flow rates up to 50 gal. per min. They are available with "open" and "closed" centre pistons and with spring and detent control arrangements for the operating levers.

The display will also include self-sealing couplings for hydraulic pressure lines.

Greenwood & Batley, Ltd., Albion Works, Leeds, 12. Stand No. 127, Ground Floor

Destined for use in the Cooksley works of Richard Thomas & Baldwins, Ltd., the battery-operated fork-lift truck illustrated in Fig. 11, which

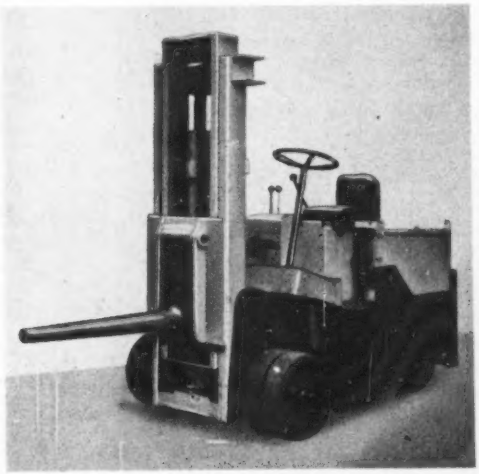


Fig. 11. Greenwood & Batley Electric Truck for Handling Heavy Coils

will be shown on this stand, incorporates a ram for carrying metal strip in coil form. It has a capacity for handling loads up to 11,000 lb. with the centre of gravity at a distance of 24 in. from the face of the ram carriage. The latter is raised and lowered hydraulically at a speed of 12 ft. per min., and a maximum distance of 9 ft. 6 in. is obtainable between the ram and the shop floor. Provision is made for tilting the mast, hydraulically, through an angle of 3 deg. forwards and 10 deg. backwards.

Battery-operated elevating platform trucks of 2 and 5 tons capacity will be displayed, as representative of the range made by the company. Another exhibit will be a 6-ton battery-operated locomotive with a draw-bar pull of 1,800 lb., which has flame-proof electrical equipment.

S. Smith & Sons (England), Ltd., Industrial Products Department, Witney, Oxon. Stand No. 307, First Floor

A new product to be shown by this company is a magnetic powder clutch, which is available in various sizes with ratings from ⅛ to 200 lb.-ft. torque, for operation on D.C. supplies from 24 to 180 volts. Designated type SFU 550/50, the clutch illustrated in Fig. 12, for example, will transmit up to 50 lb.-ft. torque, and has a 5½-in. diameter rotor on the driven shaft. It has a power consumption of only 72 watts.

The rotor on the driven shaft is surrounded by a second, cup-shaped, rotor attached to the driving shaft, and between these members there is a quantity of ferro-magnetic powder which is retained by a labyrinth sealing plate. When a non-rotating coil surrounding the assembly is energized, the resulting magnetic field causes the powder to "solidify," so that the rotors are mutually coupled for transmitting the drive. By adjusting the current that is passed through the coil, the intensity of the magnetic field may be

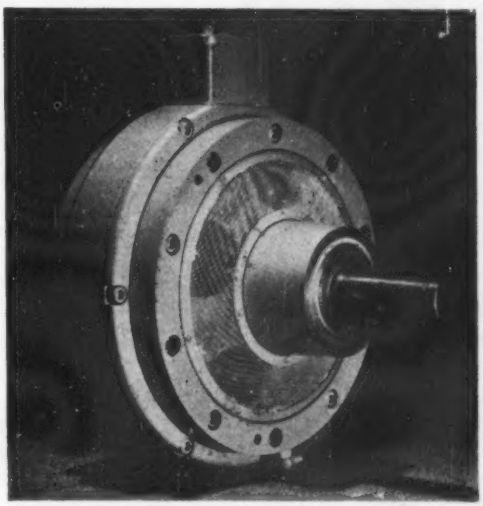


Fig. 12. An Example from the New Range of Smith's Powder-type Magnetic Clutches

L2

steplessly varied so that slip occurs when a predetermined torque value is reached.

The clutch permits smooth engagement of the drive, and, since the moving parts do not make contact with each other, wear is virtually eliminated. Because the clutch is operated electrically, it can readily be arranged for remote control.

A. Schrader's Son, Division of Scovill Manufacturing Co., 829 Tyburn Road, Erdington, Birmingham 24. Stand No. 349, First Floor

A selection from the wide range of Schrader air cylinders; control valves for hand, foot and solenoid operation; compressed air sets for the ejection of workpieces from power press, for example; and quick-acting couplings for compressed air lines, will be displayed on this company's stand.

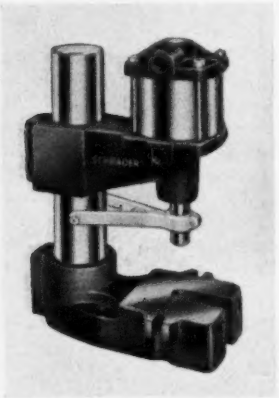


Fig. 13. Schrader Air-operated Press

The Schrader air-operated press illustrated in Fig. 13, which will be on view, has numerous applications for a variety of operations such as stamping, broaching, riveting, staking, pressing, assembling and bending. It is available with a single-acting air cylinder for impact work, which provides a ram force of twelve times that of the air line pressure. Alternatively, when squeezing operations are to be carried out, and power return of the ram is required, a double-acting cylinder can be fitted. The support bracket which carries the air cylinder is adjustable on the cylindrical column, and distances from 0 to 7 in. are obtainable between the end of the ram and the slotted work table.

Dargue Brothers, Ltd., South Parade, Halifax. Stand No. 275, First Floor

The Simplon range of drawing office equipment to be displayed by this company will include the Modular-Line cantilever drafting machine, details of which were published in MACHINERY, 90/1070—10/5/57. This equipment is made in two sizes which are fitted with double elephant and antiquarian drawing boards, and have cabinets with 82 by 36 and 70 by 36 in. top surfaces, of laminated plastics material, which serve as reference tables. The drawing board, which can be tilted, is supported by an arm fixed to the cabinet, and may be raised and lowered hydraulically. On the latest equipment which will be shown, vertical movement of the drawing board is controlled by push buttons.

Attention may also be drawn to the Simplon 3D Hydrolift drafting unit of the "free-standing" type which has a pedestal base. Drawing boards of four different sizes can be fitted, which can be tilted and swivelled, and have hydraulic vertical adjustment.

Broom & Wade, Ltd., High Wycombe, Bucks. Stand No. 342, First Floor

Examples from the Aro-Broomwade range of air-operated tools, which the company is making under licence from the Aro Corporation, U.S.A., will be displayed on this stand.

Portable drills to be shown are available for lever-operation, or with a pistol-grip handle and a built-in trigger-type control. They can be fitted with drill chucks of $\frac{3}{16}$- or $\frac{1}{4}$-in. capacity, and all moving parts run in anti-friction bearings. Weighing only 1½ lb., the screwdriver and nut runner, shown in Fig. 14, incorporates an adjustable clutch.

Other exhibits will include Aro-Broomwade spring balances of 5 and 10 lb. capacity, which may be employed for supporting the lever-operated drill in the vertical position. Attention may also be drawn to the Aro-Broomwade air-operated chain hoist, which will raise loads up to 10 cwt. through a maximum distance of 8 ft. at a speed of 25 ft. per min. Weighing only 29 lb., the hoist may be fitted with a "pull cable" control arrangement for the vane-type air motor, and the 5-in. diameter driving unit has an overall length of 10¾ in. Alternatively, a pendant control unit can be provided, and the weight of the hoist is then 34 lb. Stationary air compressors and air-operated winches will also be on view.

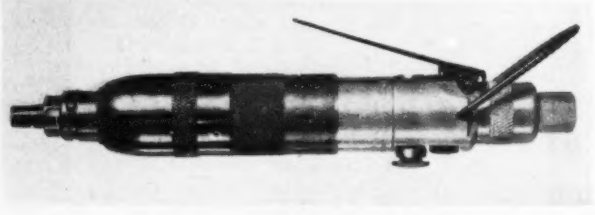


Fig. 14. Aro-Broomwade Air-operated Nut Runner

News of the Industry

Manchester and District

F. E. ROWLAND & CO., LTD., Reddish, Stockport, have in hand a large programme of duplex surface grinding machines, of 12-, 20- and 30-in. diameter capacities. In the works our attention was drawn to a 20-in. machine, under test, for grinding the ends of ½-in. diameter by ½-in. long rollers at the rate of 120 per min. This machine is arranged for automatic loading and automatic sizing, and gives a finish of 3 micro-inches. Other 20-in. machines in progress are for grinding the ends of taper rollers and for universal joints, the latter being destined for France. A recent order from Poland is for one 30-in. and three 20-in. machines, of the through-feed type, for grinding ball bearing races. We also noted two 20-in. machines, of the single-wheel type, for motor car valve tappets.

Duplex 30-in. machines are being built for grinding valve seat inserts, connecting rod ends, starter rings, and circlips, from 1 to 9 in. diameter. In course of development is a machine for grinding the ends of coil springs by the rotary method, also a single-wheel machine, of the type described in MACHINERY, 92/843—11/4/58, for diesel engine pump parts. Single- and double-ended floor grinding machines are on order with wheels from 14 to 30 in. diameter. A batch of seven, 24-in., double-ended, machines has just been completed for the new steelworks in India. Other work includes hydraulic and foundry-type abrasive wheel cutting-off machines, and cemented-carbide tool grinding machines. A diamond-wheel machine is being developed for grinding cemented-carbide tool tips.

WHARTON CRANE & HOIST CO., LTD., Reddish, Stockport, will exhibit 20-, 5- and 2-ton crane crabs at the Mechanical Handling Exhibition, to be held at Earl's Court, London, from May 7 to 17. The 20-ton crab is destined for the Atomic Energy Commission. Overhead cranes and hoists of small, medium and large capacities are on order, including six overhead cranes with lifting capacities from 100 to 150 tons. A 102-ton crane, of 90-ft. span, has recently been delivered to the Elland (Yorks) Power Station of the Central Electricity Generating Authority. We may note that special annular track cranes are to be supplied to Atomic Power Stations, and electric overhead travelling cranes, one to lift 45 tons, with a span of 80 ft., and one to lift 60 tons, with a span of 48 ft., to Scottish steelworks.

S. H. HEYWOOD & CO., LTD., Reddish, Stockport, are well employed on the production of overhead electric travelling cranes of small, medium, and large capacities, which are destined for a variety of industries. Other work in progress includes mechanical cupola charging equipment, large traversers, capstans, and grabbing cranes.

JIGS & TOOLS (STOCKPORT), LTD., Stockport, in addition to a variety of jigs, fixtures, tools and gauges, are increasingly occupied on form- and profile-grinding work. Equipment installed for the latter purpose includes Jones-Shipman surface grinding machines with Diaform grinding wheel forming attachments, and a Profiloscope. Work in hand includes form-ground dies for razor blades and laminations, also for trimming purposes; fir-tree root form gauges for turbine blades; and a variety of form tools.

DAVID BROWN MACHINE TOOL DIVISION, Sherborne Street, Manchester, report that, in spite of severe competition, they have received orders during the past ten years for 50 large turbine gear-cutting machines, with an aggregate weight of 3,000 tons, and a value exceeding £3,000,000. These machines have been supplied to customers in this country, Japan, Australia, America, France, Italy, Denmark, Germany and Switzerland. An order for the 51st machine has recently been placed by a Swedish electrical engineering company.

The machines in question, which are the largest in the David Brown range, have individual weights ranging from 20 to 120 tons each, and capacities for cutting turbine gears from 10 to 216 in. diameter. They are built to limits of accuracy which are closer in many respects than those demanded by the relevant British Standard. Since the first machine was delivered, the most important development has been the introduction, three years ago, of the combined hobbing and shaving machine for gears of this size and class, and several such machines have been among those recently ordered. Other interesting machines at present in hand include a special 50-in. hobbing machine, which will be employed by a precision engineering company in Switzerland for cutting master worm gears, and a 48-in. master hobbing machine for the

Mechanical Engineering Research Laboratory, East Kilbride, Scotland.

TAP SHARPENERS, LTD., 21B Station Road, Cheadle Hulme, Stockport, have supplied details of the latest Finney tap nose lead grinder, which is built for them by the Crescent Engineering Co., Ltd., Liversedge, Yorks. We hope shortly to make further reference to this machine, which has been developed for accurately grinding the nose lead of screwing taps. Although primarily designed for taps, the machine can be readily adapted for grinding and relieving stepped drills, the nose leads of reamers, and centre drills. A combined oscillating and reciprocating motion imparts helical-radial relief to the edges, and close concentricity is maintained to ensure balanced cutting.

THOMAS ROBINSON & SON, LTD., Rochdale, have recently developed a fully-automatic machine for trimming, marking, adzing, and boring railway sleepers at the rate of 10 per min., which we hope to describe at a later date. Orders for the machine have already been received from the Greenhill depot of British Railways; Southern Railway, Madras State, India; and Companhia Mogiana de Estradas de Ferro, Brazil. Provision is made for control by one man from a central panel.

H. B.

Letters to the Editor

[The Editor does not hold himself responsible for the views expressed by his correspondents.]

The Millionth of an Inch

(*To the Editor of* MACHINERY)

SIR,—Further to my previous letter (MACHINERY, 92/867—11/4/58), I am surprised at Mr. Alan Browne's persistence in supporting an obvious anomaly. Surely the use of "m" is too well established in the sense of thousandth—mm., msec., mH., etc., for it now to be applied to a millionth. Its use in the Metric system has gained it international recognition throughout Europe, and, in scientific and electrical engineering circles, throughout the world.

Likewise the μ symbol for millionth has already gained wide acceptance in the electrical industry, more especially in the electronic branches. Physicists too, make use of it, so that its place in technology is well established.

To use a symbol for thousandth to mean millionth would lead to the confusion we have already suffered over billion, which could mean 10^9 or 10^{12}, with the result that the new prefix Giga was ultimately adopted for 10^9 to resolve the difficulty, as in GeV.

Electrical engineers have made use of Greek letters as symbols in their work for many years now, and surely no one is going to deny π its place in the world, in any aspect of mathematics, pure or applied. With advancing techniques we shall have to extend our vocabulary, and with it, it seems our alphabet. Some branches have already over-run the entire Greek alphabet! The mil is already well established in the U.S.A. and, in some fields, is becoming more widely used here, for example, for stylus radius, magnetic tape thickness, lamination thickness, etc. If "m" has any meaning at all it is milli-inch or the English "thou."

F. W. J. CLARK.

Portsmouth.

Deep Drawing Research Group

At a luncheon held in London recently by the Institute of Sheet Metal Engineering, the principal guest, Mr. W. C. F. Hessenberg, deputy director of the British Iron and Steel Research Association, announced the formation of a British Group for research into deep drawing.

The assessment of the suitability of sheet metal for deep drawing and related processes has been investigated for a number of years by many organizations in several countries. Largely owing to lack of effective contact between the various investigators, however, much of the effort expended is considered, by many who are interested in these activities, to have been duplicated or even misplaced, with the result that those in need of guidance are faced with a variety of testing equipment, and have no clear or reliable indication of the relative merits of the various testing methods.

Because of this situation the International Deep Drawing Research Group was formed in 1957 by representatives from several European countries, with the object of exchanging information and co-ordinating further research. The representatives of Great Britain on this Group have been Mr. G. Murray (Pressed Steel Co., Ltd.), who was chairman of the Cup-Forming Test Sub-Committee of the British Iron and Steel Research Association, and Mr. J. G. Wistreich (B.I.S.R.A.). Secretarial facilities for the Group are also being provided by B.I.S.R.A.

Following an exchange of views on work which has already been carried out, the Group has decided that in the field of sheet metal testing attention will be concentrated on the cup forming test, performed substantially in accordance with the procedure evolved and evaluated by B.I.S.R.A. in the U.K. and the Jernkontoret in Sweden.

Whereas important work has been done in the

past in this country, it was felt generally that the present arrangements for fostering research and investigation into the deep drawing of metals should now be more broadly based. Informal discussions have therefore been held between B.I.S.R.A., the British Non-Ferrous Metals Research Association, the Institute of Sheet Metal Engineering, and the Production Engineering Research Association, as a result of which it was agreed to set up a British Deep Drawing Research Group.

This Group will be administered by a joint research committee, the membership of which has been drawn primarily from organizations or individuals actively engaged in work relevant to this field of activity, and is as far as possible equally representative of producers and users of sheet metal, both ferrous and non-ferrous. The chairman is Mr. G. Murray, of the Pressed Steel Co., Ltd.

Membership of the Group is open to all interested organizations and individuals in Great Britain and the Commonwealth on the basis of membership of the Institute of Sheet Metal Engineering, John Adam House, Adelphi, London, W.C.2. Under the guidance of the Joint Research Committee, the Group will be responsible for liaison with similar bodies in other countries, and for the publication of papers, and the organization of meetings in relation to its activities.

M.T.T.A. Officers and Committees

The Officer, Council and Committees of the Machine Tool Trades Association for 1958-59 are as follows: President, J. C. Robinson,; Vice-president, E. W. Field, O.B.E.; Hon. Treasurer, A. Graham Dowding.

COUNCIL (*Ex-officio members*): J. C. Robinson, E. W. Field, O.B.E., A. Graham Dowding, and the following Past Presidents: Sir Greville S. Maginness, K.B.E., Sir Lionel Kearns, C.B.E., J. B. S. Gabriel, Robert W. Asquith, R. D. G. Ryder, and H. P. Potts, also C. G. Twallin, C.B.E., and G. E. Hickman (past Hon. Treasurers). *Members elected by the Machine Tool Manufacturers' Section*: J. Archdale, J. G. Bailey, M.B.E., Col. C. W. Clark, D.S.O., O.B.E., M.C., E. W. Field, O.B.E., J. C. Snow (retiring 1959), J. W. Butler, J. E. Hill, W. V. Hodgson, R. H. Orcutt, F. E. Wand (retiring 1960), B. E. Cash, Sir Stanley J. Harley, J. G. Petter, A. E. Pollard, and E. Town (retiring 1961). *Members elected by the Machine Tool and Small Tool Importers' Section*: G. P. Barrott, A. Graham Dowding, G. W. H. Nash (retiring 1959), N. W. S. Catmur, H. A. Chambers, H. Vernon (retiring 1960), W. Core, W. G. Hunt, and T. N. Woof, M.C. (retiring 1961). *Members elected by the Woodworking Machinery Manufacturers' Section*: C. H. Morris (retiring 1959), M. A. White (retiring 1960), and A. H. Spindler (retiring 1961). *Members elected by the Allied Trades Section*: C. F. Hurst (retiring 1959), R. P. Britton (retiring 1960), A. W. Lee, and P. Neill (retiring 1961).

EXECUTIVE COMMITTEE (*Ex-officio members*): J. C. Robinson, E. W. Field, O.B.E., A. Graham Dowding, Sir Greville S. Maginness, K.B.E., Sir Lionel Kearns, C.B.E., J. B. S. Gabriel, Robert W. Asquith, R. D. G. Ryder, H. P. Potts, C. G. Twallin, C.B.E., G. E. Hickman, T. N. Woof, M.C., and P. Neill. (*Elected members*): Col. C. W. Clark, D.S.O., O.B.E., M.C., and H. A. Chambers.

MACHINE TOOL MANUFACTURERS' SECTION COMMITTEE (*Elected members*): E. W. Field, O.B.E. (chairman), J. Archdale, Col. C. W. Clark, D.S.O., O.B.E., M.C., J. G. Petter, and J. C. Snow. (*Ex-officio members*): J. C. Robinson, H. P. Potts, Sir Greville S. Maginness, K.B.E., Sir Lionel Kearns, C.B.E., Robert W. Asquith, and R. D. G. Ryder.

MACHINE TOOL AND SMALL TOOL IMPORTERS' SECTION COMMITTEE (*Elected members*): T. N. Woof, M.C. (chairman), N. W. S. Catmur, H. A. Chambers, L. J. Hugo, and G. W. Nash. (*Ex-officio members*): J. C. Robinson, E. W. Field, O.B.E., H. P. Potts, and J. B. S. Gabriel.

WOODWORKING MACHINERY MANUFACTURERS' SECTION COMMITTEE (*Elected members*): J. C. Robinson (chairman), C. H. Morris, G. R. Pickles, J. G. Sagar, and M. A. White. (*Ex-officio members*): E. W. Field, O.B.E., and H. P. Potts.

ALLIED TRADES SECTION COMMITTEE (*Elected members*): P. Neill (chairman), G. Balfour, R. P. Britton, C. F. Hurst, and A. W. Lee. (*Ex-officio members*): J. C. Robinson, E. W. Field, O.B.E., and H. P. Potts.

Glacier "Dry" Bearing Materials

The Glacier Metal Co., Alperton, Wembley, Middlesex, are introducing three new "dry" bearing materials. One type, known as DU, comprises thin steel strip with a porous bronze coating impregnated with a mixture of a fluoro-carbon plastic (P.T.F.E.) and lead. It is stated that this material provides three times the load/speed carrying capacity of the company's DP type, which is superseded, so that the range of potential applications is considerably extended. Stock ranges of bushes, thrust washes, and flat strip are available for manufacturers who wish to carry out trials.

Another material, designated DQ, is a fluorocarbon (P.T.F.E.) strengthened with special fillers, which is supplied in the form of bars and tubes of standard diameter. Dry bearings of non-standard sizes or irregular shapes can be machined from this material.

In addition, the DM process has been developed, whereby an adherent layer of a combination of fluoro-carbon and molybdenum disulphide can be applied to the bearing surfaces of customers' parts by The Glacier Metal Company. The thickness of this layer ranges from about 0·0015 to 0·0025 in.

All these materials incorporate Fluon polytetrafluoroethylene, supplied by Imperial Chemical Industries, Ltd.

Neven Grinder for Carbide Tools

The Neven Type GF/O bench-mounted grinding and lapping machine, here shown, has recently been introduced by Diamond Impregnated Products, Ltd., Tuffley Crescent, Gloucester, for grinding tungsten carbide cutting tools.

A feature of the design is that the wheelhead is oscillated at a speed of 30 strokes per min., while grinding is in progress, by a separate drive from an f.h.p. motor. As a result, the full width of the diamond wheel face is employed, so that uniform wear and long life are ensured. It is stated that grinding time is reduced on account of the oscillating motion, and that a high degree of accuracy for flatness and good surface finish are obtained on the tool faces. Moreover, less operator skill is required, since the tool has only to be pressed on to the table and held in contact with the wheel.

Neven Type GF/O Grinder for Tungsten Carbide Tools

Drive from the motor is transmitted by a speed reduction gearbox at the rear of the bed, and thence through an adjustable crank which enables steplessly-variable wheelhead strokes up to ⅝ in. on each side of the central position to be obtained. Since the driving motor is controlled by a separate switch, the oscillating motion can be readily interrupted, for example, when nose radii are to be ground on cutting tools.

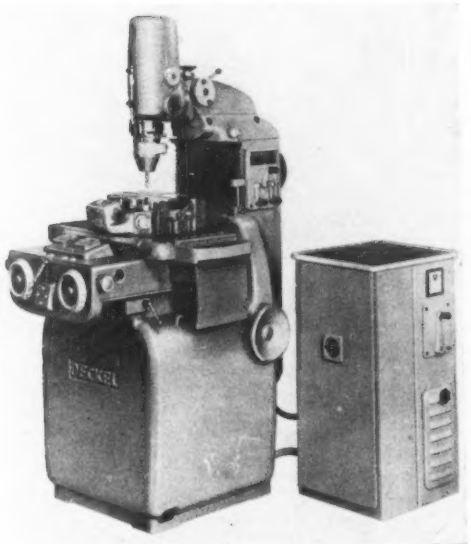
The wheelhead spindle runs in angular contact ball bearings, and a vibration-free direct drive at a speed of 2,850 r.p.m. is provided by a 1-h.p. reversing motor. Coolant is delivered to the work by a pump mounted at the rear end of the spindle-drive motor. The work table can be tilted in either direction by means of a conveniently-placed knob, and a scale is fitted to facilitate setting. Right- and left-hand cutting tools with shanks up to 1¾ by 1¾ in. square cross section can be passed under the wheel guard, and a protractor attachment is provided for mounting on the table, to permit of setting compound angles. A pivoted splash guard is fitted, which can be swung to either side of the the wheel axis, as required.

The machine is available with a cabinet base, as shown, which occupies a floor space of 24 by 19 in., and has a height of 32 in.

Grinding machines made by Impregnated Diamond Products, Ltd., for use with diamond wheels are distributed by Wickman, Ltd., Tile Hill, Coventry.

Burton Griffiths Demonstration

An exhibition and demonstration of machine tools was held recently by Burton Griffiths & Co., Ltd., at their works at Mackadown Lane, Kitts Green, Birmingham, 33. The main purpose of the demonstration was to draw attention to the range of precision machine tools made by the German firm of Deckel, including an optical co-ordinate jig-grinding machine, shown in the accompanying illustration, which is now available in the U.K. Frequency-changing equipment, housed in a separate cabinet adjacent to the machine, enables spindle speeds ranging up to 60,000 r.p.m. to be obtained, and a 15-mm. diameter grinding wheel can be used. The Deckel KF 12 die-sinking



Deckel Co-ordinate Jig Grinding Machine Shown at the Recent Exhibition and Demonstration of Machine Tools held by Burton, Griffiths & Co., Ltd.

machine, one of many in the company's range of machine tools of this type, was shown in use, milling a forging die from a 3-dimensional master. Several Deckel pantograph engraving machines were set up for the reproduction of dies to an enlarged or reduced scale, from templates or plaster casts. Various examples of intricate work produced on these machines were included in the display.

Among other machines of Continental origin shown at work during the demonstration was a Schaudt cylindrical grinding machine. Using a carefully-dressed 60 grit J grade grinding wheel, a surface-finish of 2 micro-inches was produced on plug gauges of various diameters, which were ground at intervals during the demonstration.

Part of the exhibition was devoted to Sparcatron electro-erosion equipment made by Impregnated Diamond Products, Ltd., Gloucester, and distributed by Burton Griffiths & Co., Ltd. The display included the recently-introduced Sparcatron Mk. III 6·5-kW. machine, which is of improved performance, and the Sparcard machine, described in MACHINERY, 92/687—21/3/58, which was arranged for surface hardening milling cutters of different sizes.

Exhibited for the first time in this country was the B.S.A. Acme-Gridley BRA 6-spindle bar automatic, of $\frac{7}{16}$ in. capacity, which is now in production. The machine is of compact design, being only 5 ft. 6 in. long, and it is capable of producing parts to close limits at high speed. It is similar in design to other B.S.A. Acme-Gridley machines in that it has a box-frame, with a strong upper section connecting the gear box to the spindle housing. Components produced on this machine during the exhibition included a steel pillar made from En 1 A hexagon bar, measuring 0·19 in. across the flats. The component was threaded at both ends for a distance of $\frac{5}{16}$ in., one thread being cut and the other rolled. The time per piece was 1·8 sec.

Personal

MR. L. LAMPLUGH has been appointed sales engineer to the Engineering Department of Edgar Allen & Co., Ltd., Imperial Steel Works, Sheffield.

MR. R. F. FARMER, who has been assistant secretary since 1952, has been appointed secretary of Incorporated Plant Engineers, 12 The Parade, Solihull, Warwickshire, in succession to Mr. Hadleigh S. Seaborne.

MR. JOSEPH COWLEY, assistant sales manager, of Edgar Allen & Co., Ltd., Imperial Steel Works, Sheffield, has recently retired on reaching the age of 70. He joined the company in 1902.

MR. F. BARTON has joined Newman Industries, Ltd., Yate, Bristol, as technical representative for the Machine Tool Division in the Lancashire and Cheshire areas. He will operate from the company's Manchester office.

MR. E. D. SUCH, buyer for the Anglo-Swiss Screw Co., Ltd., Trout Road, West Drayton, Middlesex, has retired after 36 years' service with the company. He has been succeeded as buyer by Mr. R. C. Emerton, who has already completed 21 years' service.

THE RT. HON. THE EARL OF VERULAM, J.P., has been elected chairman designate of the British Institute of Management, Management House, 80 Fetter Lane, London, E.C.4. He will succeed Mr. Harold Wilmot C.B.E., who will retire at the annual general meeting, on July 23, at the end of his two-year term of office.

MR. L. E. WILLSON, hitherto manager of the Southampton office of The Skefko Ball Bearing Co., Ltd., has been appointed an assistant sales manager at the head office in Luton, Bedfordshire. He has been succeeded at Southampton by MR. G. T. BODEN from the company's London office.

MR. REUBEN VINER of Viners, Ltd., Bath Street, Sheffield, 1, has been elected president of the Sheffield Cutlery Manufacturers' Association, Light Trades House, Melbourne Avenue, Sheffield, 10. He succeeds Mr. D. A. Palmer of Joseph Rodgers & Sons, Ltd., who resigned at the recent annual general meeting after holding the office for more than 20 years.

Industrial Notes

DRUMMOND-ASQUITH (SALES), LTD., inform us that the address of their Glasgow branch office is now 40 West Nile Street [Telephone number, Central 0992 (2 lines)].

LONG SERVICE AWARDS.—Gold watches were recently presented to 10 more employees of James Neill & Co. (Sheffield), Ltd., Napier Street, Sheffield, 11, to mark the completion of 25 years' service. In all, 92 of these awards have now been made by the company.

DAVY AND UNITED ROLL FOUNDRY LIMITED, Haverton Hill-on-Tees, have provided works extensions at a cost of £300,000, including a £200,000 fettling shop. One of the features of the shop is a £50,000 dust extraction plant, which is arranged to operate right to the chisel point, and is said to be the only one of its kind in the country.

THE TIN RESEARCH INSTITUTE, Fraser Road, Greenford, Middlesex. In the Spring, 1958, issue of *Tin and its Uses* there is an interesting article on tinfoil in condenser manufacture; also a report on the Tin Conference in Frankfurt. Other articles are concerned with progress in tinplate lithography, tinplate in early American living, and cyclic strength tests on solders.

PETBOW (CANADA), LTD., is the title of an associate company which has been formed by Petbow, Ltd., for the purpose of expanding the sales of their products and organizing servicing facilities. The offices and works are at 26 Taber Road, Rexdale, Ontario. A comprehensive range of standard arc-welding sets and stationary and mobile generating sets is held, also stocks of spare parts.

THE UNITED STEEL COMPANIES, LTD., 17 Westbourne Road, Sheffield, 10, have issued a report for employees under the title "Review of Progress, 1957." Extending to 32 pages, this publication is particularly noteworthy for the high standard of the illustrations many of which are in four colours. Sections are included under the headings: current developments in the works; production; financial results; management; personnel; and market prospects.

BROOK MOTORS, LTD., Empress Works, Huddersfield, have recently completed their two millionth industrial-type electric motor. Of 200 h.p., it was part of a consignment of six drip-proof motors for shipment to Mexico for driving compressors, and was ordered through the company's American subsidiary, the Brook Motor Corporation of Chicago. The first million industrial motors were completed in 46 years, and the second million in only 7½ years.

THE BRITISH STEELFOUNDERS' ASSOCIATION, Broomgrove Lodge, Broomgrove Road, Sheffield, 10, have issued an informative illustrated booklet entitled "steel castings for crushing machinery." Sections are devoted to quarried stone, cement and concrete, St. Lawrence Seaway and power projects, the reduction of materials, gyratory and cone crushers, roll crushing, ring roll mills, and milling. Some typical castings are shown.

NEWMAN INDUSTRIES, LTD., Yate, Bristol, inform us that they have been appointed sole selling agents in the United Kingdom for all heavy Hungarian machine tools. Types which have already been imported include centre lathes, radial drilling machines, and milling machines. Vertical and universal machines of the latter type, from the Csepel factory, are now installed in the company's Bristol showrooms.

PRODUCTION ENGINEERS' VISIT TO POLAND.—Some members of the Institution of Production Engineers are at present visiting Poland at the invitation of the Association of Polish Mechanical Engineers, and their tour will include works manufacturing precision instruments and tools, wireless sets, agricultural machinery, and heavy machinery, also a modern mechanized foundry, and the Institute of Metallurgy. On May 11, a party of Polish engineers will arrive in the United Kingdom on a reciprocal visit.

GORDON & GOTCH, LTD., Industrial Sellotape Division, 8-10 Paul Street, London, E.C.2, are now marketing Sellotape reinforced banding tape for use in factories and warehouses. With a minimum tensile strength of 180 lb. per in. of width, the tape is intended for strapping cartons and bales, and is claimed to be suitable for banding such items as heavy metal bars, metal pipes, prefabricated parts, electric cables, and steel wire, also for holding spares to main units in transit.

E.M.I. ELECTRONICS, LTD., Hayes, Middlesex, have developed the Type 1 hand and clothing monitor for safeguarding people engaged in work which may expose them to atomic radiation hazards. Four large area scintillation counters with special dual scintillators are used to detect, simultaneously, both alpha and beta contamination on the hands. Two probes, attached to the sides of the main cabinet, which provide separate indications of alpha and beta-gamma levels, are used to measure radiation from clothing and footwear.

THE SIR GEORGE EARLE TROPHY for a notable achievement in the cause of industrial accident prevention has been awarded this year, by The Royal Society for the Prevention of Accidents, to Imperial Chemical Industries, Ltd., "in recognition of the far-sighted policy of its board and its attitude towards the problems of industrial accident prevention, and of the altruistic and generous way in which the extensive safety knowledge accumulated within its own organization has been made available continuously to industry throughout the world."

EXTREMULTUS TRANSMISSIONS, LTD., is the title of a new company which has been formed, following a visit of Mr. Wilfred Stephens to Canada. The address of this company is 115 Sixth Avenue, Lachine, Quebec, and it will hold stocks of all types of Miraclo belts for prompt delivery, and will be fully equipped to deal with transmission problems in all branches of industry. Miraclo nylon and chrome leather belting is made jointly by Ira Stephens, Ltd., Ashton-under-Lyne, and Stephens Belting Co., Ltd.,

Birmingham, by arrangement with Sieglingriemen, Hanover, West Germany.

PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, have introduced a new transistorized pocket radiation monitor (Type PW4014), which incorporates printed wiring. It is a watertight instrument of robust construction designed for the general survey, location and measurement of radioactivity. A built-in Geiger-Muller tube permits the instrument to be used as a probe for measuring gamma radiation, and a separate mica end-window Geiger-Muller tube, with a flexible lead, can be plugged into the instrument for beta measurements.

SCHIESS A.G., Dusseldorf, and BERTHIEZ, 5 Rue Montalivet, Paris (8e), have entered into an agreement for the pooling of technical information, to further the development of their respective products, following the introduction of the Common Market. Both companies are makers of vertical boring and turning mills, planers, plano-millers, horizontal boring and milling machines and deep hole borers. The two organizations will remain completely independent as regards sales and manufacturing facilities, but they have agreed to exchange directors and Schiess have acquired a substantial financial interest in the Berthiez company.

IBM UNITED KINGDOM, LTD., 101 Wigmore Street, London, W.1.—The London Data Processing Centre, which was opened by this company last year, is based on an IBM basic 650 computer. This medium size computer is capable of making more than 78,000 additions or subtractions or 138,000 logical decisions in a minute, and has an initial drum storage capacity of 20,000 digits. The purpose of the Centre is to provide facilities for outside organizations which have not yet installed computers, or do not yet have volumes of work sufficient to justify such installation. In addition, demonstrations are organized and customers' programmes are tested.

WORLD EXPORTS OF MANUFACTURES.—According to figures published in the *Board of Trade Journal* (in millions of U.S. dollars), world exports of manufactures in 1957 were provisionally estimated at 42,657 as compared with 38,503 in 1956, and 33,974 in 1955. The percentage shares of the leading exporting countries in 1957 were as follows: U.S.A. 25.3, United Kingdom 18.1, and Germany 17.5. For these three countries, in the same order, the percentages in 1956 were 25.2, 19.1, and 16.4, and in 1955, 24.5, 19.6, and 15.5. In the second half of 1957, according to the estimated figures, the U.S.A. accounted for 24.5 per cent of the total, Germany for 18.4, and the United Kingdom for 17.8.

CAR PRODUCTION IN MARCH totalled 109,000 and this was the first occasion on which 100,000 has been exceeded in a month. In addition, nearly 33,000 commercial vehicles were produced. For the first quarter of the year, the total output of motor vehicles was 365,000. Exports of cars in March amounted to 44,500, and for the period from January to March the total was 132,000, of which 37,000 were consigned to the U.S.A. Commercial vehicle exports for the three months totalled 36,000. The value of all exported motor products in the first quarter was £129 million, and this figure included nearly £75 million for motor vehicle shipments.

J. A. CRABTREE & CO., LTD., are holding an exhibition of their products at The Griffin Hotel, Leeds, 1, from May 5 to 9. Particular attention will be drawn to their type B-15 and B-26 airbreak contactor gear, and type D-6 manual starters, together with auxiliary equipment and limit switches. Various control panels and equipment will be displayed, incorporating this gear, in order to demonstrate its versatility and the numerous applications for which it is suitable. Miniature circuit-breakers and industrial wiring accessories will also be on view. Tickets are obtainable from J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall, Staffs.

MACHINE TOOL ORDERS placed during January totalled £6,635,000 (including £1,841,000 for export). Deliveries during the month were valued at £8,595,000, of which £1,883,000 was for export. At the end of January, orders in hand amounted to £75,326,000, of which export orders accounted for £18,912,000.

In this connection it is stated that firms have recently been asked to review their order books, to ensure that no lapsed orders are including among the figures returned.

Final results for 1956, including those for firms with small outputs, which make annual returns only, were as follows: orders received £78,009,000 (including £21,395,000 for export); deliveries £95,234,000 (including £24,441,000 for export).

Machine Tool Merchants Dinner

The seventh annual dinner and dance of the British Association of Machine Tool Merchants (Inc.), St. Stephens House, Victoria Embankment, Westminster, S.W.1, was held on April 25 in the Empire Room, Trocadero Restaurant, London. Mr. Herbert Widdowson, President of the Association, proposed the toast of "The Guests," and the response was made by Sir Stanley J. Harley, B.Sc., M.I.Mech.E., M.I.Prod.E., Deputy President of The Gauge and Tool Makers' Association. The toast of "The Ladies" was then proposed by Mr. Aubrey Litton, a member of the Council, and Mrs. Harold Heliot responded.

Import Duties on Iron and Steel

The Additional Import Duties (No. 3) Order, 1958, has been made and came into operation on April 28. This Order, which implements the agreement with the European Coal and Steel Community, signed last November, has the effect of reducing the United Kingdom import duties on the main crude and semi-finished products of iron and steel, and certain forms of finished steel, to 10 per cent *ad valorem*, with appropriate adjustments to the alternative specific rates of duty. The suspension of duty on certain products until September 18 will not be affected.

Copies of the Order (S.I. 1958 No. 671) may be obtained from H.M. Stationery Office or from any bookseller. Price 3d. (by post, 5d.).

Coming Events

INSTITUTION OF ELECTRICAL ENGINEERS.—*South-Western Sub-centre.* May 8, at 3 p.m., at the Electric Theatre, Union Street, Torquay; paper on "Preventive Maintenance," by P. L. Lutte and A. G. Milne.

Obituary

MR. JOHN HAMPTON PAWLEY, a director of George Cohen Sons & Co., Ltd., died recently at the age of 78. He joined the firm 51 years ago, and until last December was in control of the company's dismantling services.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £135; clean heavy copper, untinned and free from lead and solder, £128; second grade copper wire, £122; clean light copper £119; braziery copper, £108; gunmetal, £115; brass mixed, £80; lead, net, £58; zinc, £27; cast aluminium, £84; old rolled aluminium, £112; battery lead, £31; unsweated brass radiators, £66; hollow pewter, £495; black pewter, £365.

MIDLANDS.—The problems of the scrap industry are as acute as ever, and Midland merchants are finding it very difficult to move material arising from their yards, also the large volume of processed scrap coming from local factories each week. Permit loading labels for No. 2 heavy steel scrap are now scarce, and allocations have been cut to a minimum.

Bundles, also, are arising in greater quantities than can be absorbed, and in consequence, prices offered by merchants for light iron and light steel scrap are falling rapidly. Movements of steel turnings are curtailed but chipped turnings can be placed in markets outside the Midlands. Large quantities of bulky turnings are being stored or dumped. Cast iron borings can be delivered provided that they are clean and dry.

Foundry trade is varied, cast iron of the heavier type being mainly in demand. It is not easy to find buyers for light cast iron, and stocks are accumulating at yards. Short heavy steel scrap outlets are restricted, and it is unlikely that buyers, in the near future, will renew orders at the full control price.

It is hard to forecast the future prospects of the trade, but unless the position improves rapidly, many merchants will not be able to despatch scrap of most grades after about Tuesday of each week.

Low nickel scrap and high-speed steel scrap cannot be placed in the Sheffield area at anything like the prices which were obtained last year.

The large reserve stocks at steelworks show no signs of falling, and steel scrap buying prices must be reduced to enable merchants to carry large stocks.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., Commercial Road, E.14.
‡ Subject to market fluctuations.

Gear Production by Powder Metallurgy

(*Continued from page* 995)

which helps to maintain a film of lubricant.

Apart from the high surface finish mentioned, metal powder gears can be produced with optimum tooth shapes which can be consistently maintained during long runs, particularly if cemented carbide dies are employed. Tooth uniformity and smoothness help to ensure quiet running, and the inherently low resonance of porous sintered steel, particularly when impregnated with lubricant, also contributes towards reduction of noise.

In view of the properties obtainable and the savings that could be achieved in many instances, it would appear desirable that careful consideration should be given to the wider adoption of metal powder gears, even where operating conditions are fairly severe.

Machine Tool Share Market

The main feature of stock markets last week was the continued firmness of British Government and other fixed-interest stocks, which were active, and closed higher on balance. Except in this section, business showed no appreciable expansion, but a firm undertone was maintained in practically all markets, influenced by the strength of gilt-edged stocks.

Trading in commercial and industrial shares remained low with moderate and selective buying, and apart from a few firm spots, price changes on the week were small and irregular.

Machine tool issues showed a few gains. Armstrong Stevens advanced 1s. 3d. to 7s. 10½d.; Birmingham Small Arms, 1s. to 28s. 6d.; Asquith Machine Tool, 4½d. to 18s. 1½d.; Broom & Wade, 7½d. to 10s.; Clarkson Engineers, 3d. to 11s. 3d.; Churchill Machine Tool, 10½d. to 19s. 4½d.; and Alfred Herbert, 2s. 6d. to 67s. 6d. B. & S. Massey at 7s. 9d., Samuel Osborn at 16s. 6d., and Ambrose Shardlow at 33s., each gained 6d. On the other hand, British Oxygen fell 1s. to 34s. 6d.; Geo. Cohen, 3d. to 11s. 9d.; and Thos. W. Ward, 1s. 10½d. to 75s. 7½d.

CHURCHILL MACHINE TOOL CO., LTD. Final dividend of 17½ per cent, making a total of 27½ per cent for 1957.

NEWMAN INDUSTRIES, LTD. Dividend of 10 per cent (same).

CRAVEN BROS. (MANCHESTER), LTD. Final dividend of 5 per cent, making, with the interim, a total of 7½ per cent for 1957, against the previous dividend of 10 per cent.

Trade Publications

AUTOMATIC STRAPPING MACHINES, LTD., 44 Uxbridge Road, Ealing, London, W.5. Leaflet describing the Saxmayer type SR1A machine for automatically tying bundles, packages, and parcels with sisal cord.

KEELAVITE ROTARY PUMPS & MOTORS, LTD., Allesley, Coventry. Folder drawing attention to the principal features of the company's hydraulic power packs which are built from standard units. Another leaflet is devoted to Keelavite pumps and motors which can be supplied in six basic sizes covering horse-powers up to 300.

ROTAX, LTD., Willesden Junction. London, N.W.10.—Informative booklet entitled "Magnetic Amplifiers Used as Generating System Protection Units." Alternative methods are described for providing effective protection for aircraft generating schemes. These methods are based entirely on magnetic amplifiers, and are claimed to be both flexible and reliable.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	7/10½
Allen (Edgar) & Co., Ltd.	Ord.	£1	28/-
" "	5% Prf.	£1	15/-*
Arnott & Harrison, Ltd.	Ord.	4/-	13/9
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	18/1½
" "	6% Cum. Prf.	£1	17/9
Birmingham Small Arms Co., Ltd.	Ord.	£1	28/6
" " "	5% Cum. "A" Prf.	£1	15/6
"	6% Cum. "B" Prf.	£1	17/6
" "	4% 1st. Mort. Deb.	Stk.	85/-
British Oxygen Co., Ltd.	Ord.	£1	34/6
" "	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	5/-
Broom & Wade, Ltd.	Ord.	5/-	10/-
"	6% Cum. Prf.	£1	17/9
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/4½
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	6/-
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/6
" " "	6% Cum. Prf.	£1	25/7½
Churchill Machine Tool Co., Ltd.	Ord.	5/-	19/4½
" " "	6% Cum. Prf.	£1	18/9
Clarkson (Engrs.), Ltd.	Ord.	5/-	11/3
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/9
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	13/3
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	9/-
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/-
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	46/10½
Harper (John) & Co., Ltd.	Ord.	5/-	14/-
" "	4½% Red. Cum. Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	67/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/3
" "	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	20/9
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	45/-
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/6
Kitchen & Wade, Ltd.	Ord.	4/-	9/9
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/9
Modern Engineering Machine Tools, Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	4/6
Newman Industries, Ltd.	Ord.	2/-	2/6
" "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	4/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	16/6xd
" " "	5½% Cum. Prf.	£1	24/6
Pratt (F.) & Co., Ltd.	Ord.	5/-	21/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	33/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	11/10½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	35/-
" " " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	4/6
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	75/7½
" "	5% Cum. 1st. Prf.	£1	15/6
" "	5% Cum. 2nd Prf.	£1	24/9
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

British Exports of New Machine

Countries	Vertical Boring Machines		Other Boring Machines		Drilling Machines		Grinding, Lapping and Honing Machines		Automatic Lathes		Capstan and Turret Lathes		Other Lathes		Screwing Machines	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Commonwealth																
South Africa	1,171 (12)	31,568	1,797 (22)	38,937	6,523 (598)	139,319	4,146 (840)	130,634	1,175 (23)	50,216	5,293 (134)	218,202	11,414 (401)	321,116	55 (8)	1,940
India	3,268 (26)	96,076	6,613 (81)	176,075	15,716 (323)	387,620	11,043 (565)	382,585	2,186 (34)	84,575	11,278 (237)	450,566	12,197 (194)	320,634	682 (40)	33,271
Pakistan	—	—	12 (8)	1,115	794 (48)	14,788	613 (103)	26,945	162 (3)	5,118	985 (13)	30,835	1,154 (22)	24,251	137 (12)	5,298
Australia	436 (7)	15,688	5,182 (61)	155,316	7,884 (298)	194,608	8,643 (253)	291,917	7,633 (101)	371,246	8,510 (249)	307,705	11,478 (507)	339,373	1,203 (46)	65,968
New Zealand	84 (3)	3,071	140 (7)	7,045	1,729 (199)	36,610	976 (672)	31,967	125 (3)	3,527	420 (9)	23,182	3,318 (256)	101,082	2 (1)	92
Canada	1,991 (14)	58,233	880 (7)	33,402	11,836 (416)	244,463	5,353 (258)	194,454	1,955 (28)	88,367	4,013 (100)	174,316	15,405 (540)	440,391	404 (10)	14,753
Miscellaneous	801 (19)	21,674	1,256 (91)	46,554	5,758 (879)	137,038	3,833 (675)	113,549	272 (8)	13,061	2,065 (46)	72,731	11,300 (465)	328,023	516 (67)	20,986
Foreign																
Soviet Union	—	—	5,015 (3)	85,216	759 (6)	20,234	9,283 (38)	341,295	—	—	—	—	—	—	—	—
Sweden	704 (3)	17,446	290 (3)	8,120	2,072 (46)	62,752	656 (75)	27,309	900 (14)	49,576	2,664 (103)	127,534	875 (56)	37,256	46 (7)	3,713
Norway	125 (2)	3,545	49 (3)	1,878	1,192 (52)	27,345	317 (48)	12,647	409 (6)	20,741	244 (8)	11,953	557 (112)	18,946	61 (2)	1,456
Denmark	—	—	276 (4)	8,172	823 (38)	17,822	213 (23)	9,138	259 (5)	11,940	459 (13)	27,219	512 (66)	14,279	23 (2)	1,635
Western Germany	608 (4)	45,080	917 (3)	24,153	1,297 (15)	36,438	1,332 (56)	91,503	4,214 (56)	241,690	322 (8)	17,397	2,000 (40)	72,613	76 (4)	5,835
Netherlands	553 (5)	14,487	929 (6)	31,522	2,111 (146)	50,512	1,091 (115)	44,943	390 (6)	16,349	2,909 (85)	137,094	1,712 (139)	52,928	104 (4)	5,460
Belgium	125 (1)	3,176	1 (1)	228	1,899 (106)	40,272	824 (82)	32,303	421 (10)	23,160	2,104 (59)	69,848	1,540 (206)	40,103	19 (1)	1,624
France	1,792 (17)	58,126	381 (18)	20,438	846 (42)	24,333	8,318 (189)	365,759	4,638 (42)	219,706	4,213 (85)	173,232	1,364 (224)	55,908	56 (2)	2,778
Switzerland	128 (1)	3,795	7 (7)	643	1,423 (60)	40,142	691 (52)	31,539	234 (8)	9,052	1,485 (37)	74,575	1,057 (92)	32,042	39 (2)	3,231
Spain	794 (7)	33,288	3,407 (19)	111,450	4,727 (73)	135,098	4,318 (59)	182,288	3,290 (48)	174,662	2,710 (37)	135,390	1,882 (17)	59,849	243 (11)	17,823
Italy	12 (2)	594	3 (2)	502	110 (8)	7,600	962 (50)	38,722	6,138 (37)	345,507	770 (17)	22,240	189 (35)	8,830	21 (4)	1,845
U.S. America	2,624 (19)	71,298	972 (8)	28,831	14,903 (276)	320,323	3,085 (155)	141,310	3,562 (61)	195,417	7,798 (168)	361,151	27,432 (1,263)	763,842	899 (18)	26,073
Miscellaneous	215 (13)	6,355	1,452 (48)	70,532	5,250 (925)	131,126	6,765 (1,241)	281,876	4,314 (43)	209,961	3,142 (95)	132,412	10,565 (748)	337,500	345 (25)	14,198
Total	15,431 (155)	483,500	29,579 (402)	850,129	87,652 (4,554)	2068443	72,462 (5,549)	2772683	42,277 (536)	2133871	61,384 (1,503)	2567582	115951 (5,383)	3368966	4,931 (266)	227,979

Total exports of reconditioned machine tools:—Quantity: No., 1,325; Weight, 67,885 cwt.; Value, £775,623.
Total exports of imported machine tools:—Quantity: 23,548 cwt.; Value, £760,339.

British Imports of New Machine

Country of Origin	Boring and Broaching Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Automatic Lathes	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Western Germany	20,117 (102)	889,973	3,634 (189)	150,725	4,374 (94)	308,987	20,444 (586)	969,281	19,910 (484)	1,004,426
Belgium	3,980 (21)	130,456	67 (29)	2,505	—	—	1 (1)	166	454 (11)	14,910
France	1,642 (4)	69,527	2 (2)	375	—	—	371 (25)	29,470	2,837 (51)	185,667
Switzerland	8,589 (115)	696,487	426 (60)	22,231	705 (43)	74,938	4,343 (252)	361,179	8,437 (267)	592,637
U.S. America	2,928 (14)	237,069	576 (12)	67,435	6,524 (64)	493,706	6,729 (104)	622,419	6,031 (61)	389,783
Miscellaneous	17,097 (106)	392,523	3,640 (137)	168,792	1,080 (14)	22,454	4,970 (195)	256,270	4,295 (69)	191,836
Total	54,353 (362)	2,416,035	8,345 (429)	412,063	12,683 (215)	900,085	36,858 (1,163)	2,238,785	41,964 (943)	2,379,259

Total imports of reconditioned machine tools. Quantity:—No., 281; Weight, 12,025 cwt.; Value, £341,986.

Tools and Parts during 1957

Threading Machines		Milling Machines		Gear-cutting Machines		Planing, Shaping and Slotting Machines		Presses		Sheet Metal-working Machines		Sawing Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
142 (7)	3,651	3,485 (58)	148,355	30 (1)	643	2,081 (37)	47,079	8,047 (202)	142,957	747 (35)	14,644	1,234 (83)	26,659	5,159 (399)	134,916	6,286	161,733	58,785 (2,860)	1,612,569
420 (18)	17,539	6,676 (127)	296,776	186 (3)	11,525	7,337 (91)	155,050	17,361 (298)	328,773	3,359 (86)	61,151	623 (36)	13,376	11,619 (436)	316,019	4,256	203,728	114,820 (2,595)	3,335,339
—	—	312 (12)	9,034	235 (2)	10,735	422 (10)	8,919	713 (20)	20,011	70 (8)	1,171	69 (11)	1,808	1,207 (33)	25,910	196	8,798	7,081 (305)	194,736
829 (32)	43,826	9,096 (245)	395,278	23 (1)	1,960	6,939 (137)	146,221	44,466 (650)	739,050	2,683 (25)	45,241	1,143 (36)	29,015	13,219 (553)	358,963	11,489	458,052	140,856 (3,201)	3,959,427
68 (10)	1,963	897 (29)	36,034	—	—	691 (65)	15,170	3,010 (166)	63,921	245 (43)	4,376	340 (68)	7,441	1,541 (369)	30,781	726	27,639	14,312 (1,900)	393,901
815 (19)	42,194	5,799 (115)	149,992	350 (8)	22,140	3,403 (102)	71,104	5,437 (343)	109,383	1,201 (11)	19,317	1,125 (106)	23,478	3,804 (208)	121,353	15,808	392,669	77,579 (2,285)	2,200,009
169 (12)	5,660	1,726 (51)	82,167	76 (2)	1,991	2,525 (83)	59,527	6,464 (411)	107,035	1,060 (54)	29,343	1,215 (150)	28,592	3,193 (459)	81,023	3,327	111,511	45,556 (3,472)	1,260,465
—	—	—	—	245 (1)	12,953	—	—	24,817 (34)	364,852	1,497 (2)	18,454	—	—	8,869 (36)	163,960	205	5,744	50,690 (120)	1,012,708
624 (6)	29,191	1,428 (14)	56,722	73 (1)	5,145	— (1)	22	6,981 (19)	143,289	—	—	38 (2)	791	3,058 (143)	154,496	1,739	73,016	22,148 (493)	796,378
1 (1)	184	251 (6)	14,398	—	—	273 (14)	5,818	322 (7)	13,817	2,550 (3)	40,777	42 (6)	1,126	304 (19)	12,720	153	13,386	6,850 (289)	200,737
4 (2)	601	180 (1)	8,400	—	—	314 (17)	5,902	49 (1)	3,060	24 (1)	1,384	8 (1)	269	167 (94)	8,136	210	12,311	3,521 (268)	130,268
1,207 (14)	77,042	1,571 (19)	80,878	1,720 (15)	89,653	49 (3)	2,100	888 (7)	35,165	53 (3)	2,384	—	—	2,224 (87)	132,984	3,124	86,626	21,602 (334)	1,041,541
—	—	778 (26)	38,406	324 (2)	15,084	233 (9)	6,480	6,847 (164)	150,804	150 (2)	3,243	120 (17)	2,736	1,242 (65)	33,316	7,129	133,044	26,622 (791)	736,408
104 (1)	6,512	223 (10)	7,820	40 (1)	2,589	440 (18)	10,492	971 (11)	54,772	373 (8)	9,821	832 (10)	11,842	2,336 (202)	59,619	1,734	76,555	13,986 (727)	450,736
1,050 (18)	67,224	2,697 (36)	132,202	1,744 (20)	86,511	1,638 (43)	42,901	11,224 (42)	230,160	25 (1)	1,385	219 (23)	4,973	11,195 (167)	436,478	2,247	130,486	53,647 (969)	2,052,600
30 (1)	549	1,767 (27)	83,355	46 (1)	2,834	14 (5)	355	556 (3)	14,993	—	—	71 (9)	1,408	1,024 (33)	48,764	490	33,795	9,062 (338)	381,072
210 (5)	15,834	2,192 (27)	103,000	1,296 (14)	52,792	2,618 (5)	44,315	5,134 (14)	101,268	239 (1)	6,251	284 (9)	9,303	4,946 (33)	120,700	1,088	38,388	39,378 (379)	1,341,699
192 (4)	15,038	35 (2)	799	1,647 (8)	83,018	—	—	5,319 (13)	125,389	163 (3)	3,382	—	—	2,494 (40)	143,788	1,046	53,002	19,101 (225)	850,256
1,620 (25)	96,442	5,120 (103)	139,011	406 (5)	25,370	2,872 (44)	40,950	1,411 (182)	50,773	258 (4)	11,432	148 (21)	2,812	2,549 (184)	92,203	6,523	266,878	82,182 (2,536)	2,634,116
1,447 (27)	132,923	4,831 (134)	219,001	2,472 (4)	77,540	5,851 (270)	129,694	15,709 (1,048)	326,991	4,270 (120)	89,572	1,103 (121)	28,468	9,374 (819)	359,011	4,026	184,147	81,131 (5,681)	2,731,307
8,932 (202)	556,373	47,064 (1,042)	2001628	10,913 (89)	502,483	37,700 (954)	792,099	165726 (3,635)	3126463	18,967 (410)	363,328	8,614 (709)	194,097	89,524 (4,379)	2835140	71,802	2471508	888,909 (29,768)	27,316,272

Figures in parentheses denote number of machines. * Not including machine tool cutting parts.

Tools and Parts during 1957

Other Lathes		Milling Machines		Planing, Shaping and Slotting Machines		Presses and Sheet Metal-working Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
2,043 (299)	108,210	26,052 (352)	1,186,173	4,365 (51)	125,137	26,136 (345)	702,902	46,609 (1,892)	1,999,370	17,632	952,702	191,316 (4,394)	8,397,886
516 (6)	22,808	14 (2)	675	35 (1)	719	1,147 (20)	20,465	466 (42)	19,167	287	22,218	6,967 (133)	234,089
339 (10)	16,727	5,004 (78)	263,999	131 (4)	4,860	591 (9)	25,735	2,024 (42)	64,779	1,702	117,378	14,643 (225)	778,517
893 (52)	51,014	6,717 (93)	351,817	494 (14)	39,967	4,448 (62)	166,799	1,692 (207)	161,184	2,138	301,943	38,882 (1,165)	2,820,196
486 (7)	34,056	8,786 (42)	516,176	1,834 (14)	111,827	3,900 (36)	171,202	26,688 (224)	2,183,126	19,929	2,209,227	84,411 (578)	7,036,026
2,264 (43)	47,840	9,472 (238)	348,989	3,319 (19)	42,376	6,163 (125)	183,051	6,834 (244)	270,767	3,704	238,342	62,838 (1,190)	2,163,240
6,541 (417)	280,655	56,045 (805)	2,667,829	10,178 (103)	324,886	42,385 (597)	1,270,154	84,313 (2,651)	4,698,393	45,392	3,841,810	399,057 (7,685)	21,429,954

Figures in parentheses denote number of machines. * Not including machine tool cutting parts.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig-Iron

Foundry and Forge No. 3, Class 2

Middlesbrough zone	£21 6 0
Birmingham	£20 18 3

Phos. 0·1 to 0·75%

Birmingham	£23 17 0

Scottish Foundry

Grangemouth	£25 3 6

Hæmatite English No. 1

N.E. and N.W. Coast	£25 6 6
Scotland	£25 13 0
Sheffield	£26 15 0
Birmingham	£27 4 0

Welsh

£25 6 6

Steel Products

Medium plates	£45 11 6
Mild steel plates, ordinary*	£42 2 0
Boiler plates*	£44 12 0
†Flat bars 5 in. wide and under †Round bars under 3 in.	£40 0 6
Billets, rolling quality, soft U.T.	£32 15 6

Phosphor Bronze

Ingots (2B8) (A.I.D.) d/d	£240 0 0

Copper

Cash (mean)	£183 15 0
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG	£238 5 0—£238 10 0
Rods $\frac{7}{16}$ in. to $\frac{3}{4}$ in. diam.	£261 5 0
Tubes, $1\frac{1}{2}$ in. bore by 10 SWG, ton lots, per lb.	2s. 6½d.
Wire rod, black, hot-rolled ($\frac{1}{4}$-$\frac{7}{16}$ in.) English	£193 12 6

Zinc

Refined, minimum 98 per cent. purity, current month (mean)	£63 17 6

Brass

Tubes, solid drawn, per lb.	1s. 5½d.
Strip 63/37, 6 in. by 10 SWG coils, ton lots	£208 0 0—£210 10 0
Rods, $\frac{1}{4}$-3 in. diam. (59 per cent copper)	1s. 8½d.

Yellow Metal

Condenser plates, per ton	£146 0 0
Rods, per lb.	1s. 9½d.

Aluminium

Ingots min. 99·5 per cent Canadian d/d	£180 0 0

Lead

Refined, minimum 99·97 per cent purity, current month (mean)	£75 8 9

Tinplates

‡U.K. Home trade: Handmill f.o.t. makers' works	£3 11 8½
Cold reduced, f.o.t. makers' works	£3 7 4½
U.K. Export: Hot rolled basis, f.o.t. works' port	74s. 0d.—76s. 0d.
Cold reduced basis, f.o.t. works' port	76s. 0d.

Gunmetal

Ingots, 85.5.5.5. ex works[7]	£154 0 0

* N.E. Coast, N. Joint Area, Central Scottish Zone.

† U.T. soft basic.

‡ Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f, ex works 2 ton basis	£42 17 0
Free cutting black	£47 6 6

Reeled Steel Bars[1]

Single-reeled 1½ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 9 6
Free cutting	£47 19 0

High-Speed Steel

Black random length bar. All prices basic, per lb., subject to extras.

Molybdenum "66"	5s. 10½d.
Molybdenum "46"	5s. 8½d.
14 per cent tungsten	5s. 9d.
16 per cent tungsten	6s. 1½d.
18 per cent tungsten	6s. 4d.
22 per cent tungsten	7s. 5d.
5 per cent cobalt 4·75/5·25 per cent molybdenum + 6·0/6·75 per cent tungsten + 1·75/2·05 per cent vanadium (5-6-2)	9s. 6d.

Precision-ground, High-speed Free-turning Brass Rod[3]

½-in. dia. ± 0·00025-in. 2-ton lots, per lb.	2s. 2½d.

Grey Iron Rod

Die Cast[3] in random lengths 18 in. to 24 in. rough machined $\frac{1}{16}$-in. above listed size. Extra for definite lengths, for hardenable alloy iron, and for orders of less than £50. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
¾ or ⅞ in.	255s. 6d.	318s. 10d.
1 or 1¼ in.	204s. 4d.	251s. 10d.
1½ to 1¾ in.	143s. 0d.	171s. 2d.
1⅞ to 2 in.	106s. 2d.	125s. 11d.
2¼ to 3¼ in.	91s. 6d.	106s. 4d.
3½ to 12 in.	86s. 6d.	99s. 2d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. dia. + 0·010 to 0·020 in., prices as quoted for die cast bar[6]

6-ft. lengths centreless ground + 0·010 in. Extra for hardenable alloy iron[4]	¾ or ⅞ in.	245s. 4d.
	1 or 1¼ in.	196s. 4d.
	1½ to 1¾ in.	137s. 10d.
	1⅞ to 2 in.	106s. 2d.
Per cwt. net	2¼ to 3 in.	91s. 6d.

Stellite[5]

Welding Rods plain

¼ in. dia. per lb.	30s. 0d.

Toolbits

½ in. sq. × 4 in., each	22s 3d.

Precision-ground Mild Steel[3]

1-in. dia. + 0·00025-in. 4-ton lots, per cwt.	121s. 6d.

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. 2 Pratt, Levick & Co., Ltd., Chester. 3 Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. 4 "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. 5 Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn: (Usaspead) over 1½ to 2 in.	£59 17 6
Lead bearing (Usaled)	£64 4 0
Precision ground, 1¾ in.	£81 12 6

Bright Drawn

M.S. bars (M.M.C.) over 1½ in. to 2 in.	£55 3 6
Square edge flats (Usaflat)	£72 0 0
M.S. angles (Usaspead)	£99 10 0
Casehardening (EN) (Usacase) over 1½ in. to 2 in.	£63 9 6
M.S. bars (EN3B) (Usamild) over 1½ to 2 in.	£57 3 6
Carbon manganese semi-freecutting case hardening (EN202) (Usaspead 202) over 1½ to 2 in.	£72 19 0
35/45 ton tensile (EN6) (Usen) over 1 to 1½ in.	£64 17 6
0·4 Carbon Normalised (Usaspead "40") over 1½ in. to 2 in.	£66 19 6
Carbon manganese steel to Specification EN.16.T (Usaspead 5565), per ton	£127 11 3

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices less 5 per cent

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.) ¾ in. to 2¾ in., per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.) ¾-in. to 2¾-in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to 1½-in.) Genuine Stubs quality, per lb.	4s. 6d. less 27½%
M.M.C. quality, per lb.	2s. 5d. + 6½%
Boxes of 16 assorted sizes $\frac{1}{32}$-in. to ½-in. dia.	7s. 6d.

Stainless Steel

K.E. 40.AM (Freecutting), per lb. 3s. 3½d.

Glacier Machined Bronze Bars

Phosphor bronze (2B8)
Lead bronze
} Prices on application

High-speed Steel

18 per cent tungsten. Prices on application.

Toolholder bits:
Usaspead "Super"
" "Supreme"
" Cobalt 10
} List price

Shimstock

Steel assorted, per tin	3s. 6d.
Brass " "	7s. 3d.

6 Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.